United States Court of Appeals

for the

District of Columbia Circuit

TRANSCRIPT OF RECORD

33

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TRANSCRIPT OF RECORD

United States Court of Appeals for the District of Columbia

APRIL TERM, 1935

No. 6510

744

ECONOMY FUSE AND MANUFACTURING
COMPANY, APPELLANT,

vs.

CONWAY P. COE, COMMISSIONER OF PATENTS.

APPEAL FROM THE SUPREME COURT OF THE DISTRICT OF
COLUMBIA.

FILED JULY 2, 1935.

PRINTED AUGUST 29, 1935.

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OF THE CITY OF NEW YORK

United States Court of Appeals for the District of Columbia

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ECONOMY FUSE AND MANUFACTURING COMPANY, APPELLANT,

vs.

CONWAY P. COE, COMMISSIONER OF PATENTS, APPELLEE.

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United States Court of Appeals for the District of Columbia

No. 6510.

Economy Fuse and Manufacturing Company, Appellant,

vs.

Conway P. Coe, Commissioner of Patents.

a Supreme Court of the District of Columbia.

In Equity.

No. 55555.

Economy Fuse and Manufacturing Company, Plaintiff,

vs.

Thomas E. Robertson, Commissioner of Patents,
Defendant.

United States of America,
District of Columbia, ss:

Be it remembered, That in the Supreme Court of the District of Columbia, at the City of Washington, in said District, at the times hereinafter mentioned, the following papers were filed and proceedings had, in the above-entitled cause, to wit:

1 *Bill to Enforce Issue of Patent.*

Filed April 13, 1933.

In the Supreme Court of the District of Columbia.

In Equity.

No. 55555.

Economy Fuse and Manufacturing Company, Plaintiff,

vs.

Thomas E. Robertson, Commissioner of Patents,
Defendant.

To the Honorable the Judges of the Supreme Court of the District of Columbia:

Economy Fuse and Manufacturing Company, a corporation organized and existing under the laws of the State of New York, and having an office and place of business at Chicago, Illinois, brings this, its Bill of Complaint against Thomas E. Robertson, who is the United States Commissioner of Patents, and is made a party hereto as said Commissioner, having official residence at the City of Washington, D. C.

This suit is brought under and pursuant to Section 4915 of the Revised Statutes of the United States, which provides for a Bill in Equity in case of refusal by the Commissioner of Patents to grant Letters Patent on an application duly filed and prosecuted in the United States Patent Office; and thereupon

For its Cause of Action, Plaintiff Shows:

2 I.

That prior to about January 21, 1929, Oscar A. Cherry and Franz Kurath, citizens of the United States, and then residing in the City of Chicago, County of Cook, State of Illinois, respectively, were the original first and joint inventors of new and useful Moldable Composition of Matter and Process for Producing Same, which invention was not known or used by others in this country before their said invention thereof, and not patented or described in any printed publication in this or any other country before their invention or discovery thereof, or more than two years prior to the filing in the United States Patent Office of their hereinafter designated application for United States Letters Patent, and not in public use or on sale in the United States for more than two years prior to their said application for Letters Patent therefor, and which invention had not been patented by them or their legal representatives or assigns in any foreign country upon an application filed more than one year prior to the filing of their hereinafter recited application for United States Letters Patent, and which invention had not been abandoned.

II.

That on the 21st day of January, 1929, said Oscar A. Cherry and Franz Kurath duly filed in the Patent Office of the United States an application in due form of law for Letters Patent for said invention, the said application receiving Patent Office Serial No. 334,132, and filed in the United States Patent Office, a written description of the said invention in such full, clear, concise and exact terms as to enable any person skilled in the art or science to which it appertains to practice and use the same, 3 and particularly pointed out and distinctly claimed the said process which they claim as their invention, a certified copy of which application and the actions and proceedings in the Patent Office thereon plaintiff is ready in Court to produce as this Honorable Court shall direct.

III.

That subsequent to the filing in the United States Patent Office of the said application, due proceedings were had thereon before the Primary Examiner of applications relating to the subject-matter of said invention, such proceedings comprising actions by the said Primary Examiner in which prior United States patents were cited in rejecting the claims from time to time presented in said application, and amendments and arguments presented on behalf of the said applicants in reply to the said actions by the said Primary Examiner, and as a result of such proceedings, on January 15th, 1932, the said Primary Examiner finally rejected the claims of said application, which were and are as follows:

"8. A thermoplastic molding composition comprising a thermoplastic reactive resinous binder and a filler consisting of relatively short lengths of spun fibrous material in string-like form.

9. A thermoplastic molding composition comprising a thermoplastic reactive resinous binder and a filler coated with the binder consisting of relatively short lengths of spun fibrous material in string-like form.

10. A thermoplastic molding composition of substantially uniform quality and having a high degree of flowability into irregular molded shapes comprising a thermoplastic reactive resinous binder and a filler coated with the binder consisting of pieces of spun fibrous material in string-like form of a length less than two inches.

4 11. The process of molding which consists in coating a continuous length of spun fibrous string material with a solution of a thermoplastic reactive resin, drying the coated string, cutting the coated string into relatively short lengths and molding an intermingled mass of the short lengths of string under conditions of heat and pressure in such a manner that the mass flows to an appreciable extent during molding.

12. The process of molding which consists in coating a continuous length of spun fibrous string material with a solution of a thermoplastic reactive resin, drying the coated string, cutting the coated string into pieces of length less than two inches and causing an intermingled mass of the coated pieces of string to flow under conditions of heat and pressure in a mold.

13. A molded article of manufacture of irregular shape and uniform quality having a high tensile strength and high resistance to fracture by impact comprising an insoluble and infusible resin and a filler of relatively short lengths of spun fibrous string-like material formed in situ."

IV.

That on the 8th day of February, 1932, an appeal was duly taken to the Board of Appeals of the United States Patent Office from the final rejection by the said Primary Examiner of the claims; and thereafter the said Board of

Appeals, after due proceedings, did, on the 17th day of October, 1932, render and file a decision affirming that of the Primary Examiner in finally rejecting the claims, and by the said decision of the said Board of Appeals, being the highest tribunal of the Patent Office having power and authority to determine finally the action of the Patent Office and of the Commissioner of Patents in respect to the granting of patents, a patent to plaintiff, as assignee of the said Oscar A. Cherry and Franz Kurath, for the invention described in said claims was thereby refused.

V.

That the entire right, title and interest in and to said invention and Letters Patent of the United States to be issued therefor were, by an instrument in writing, and now are, vested in the plaintiff, Economy Fuse and Manufacturing Company, as will more fully appear by said assignment, which was duly recorded on January 21st, 1929, in Liber S-137, Page 504, of Transfers of Patents, which assignment or a certified copy thereof the plaintiff is ready in Court to produce as this Honorable Court shall direct.

Wherefore, and forasmuch as the plaintiff can have no adequate relief except in this Court, this Bill of Complaint is brought under and in accordance with the provisions of Section 4915 of the Revised Statutes of the United States in such case made and provided; and the plaintiff prays that this Honorable Court, on notice to the defendant, and other due proceedings had, may adjudge the said Oscar A. Cherry and Franz Kurath to be the first, original and joint inventors of the invention set forth in the claims of the said application, and the plaintiff to be entitled according to law to have Letters Patent granted to it as the assignee of the said Oscar A. Cherry and Franz Kurath for said invention as set forth in said application and described in the claims thereof; and that the said defendant, Thomas E. Robertson, Commissioner of Patents, or his successor in office, be authorized to issue Letters Patent to the plaintiff, Economy Fuse and Manufacturing Company, for said invention, as defined in said designated claims; and for such other and further relief in the premises as equity may require and to your Honors may seem meet.

6 And may it please your Honors to grant and cause to be issued, in accordance with Section 4915 of the Revised Statutes of the United States, as amended by the Act of March 3, 1927, a writ of *subpœna ad respondendum* of the United States, issuing out of and under the seal of this Honorable Court, directed to the defendant, Thomas E. Robertson, as Commissioner of Patents, commanding him on a day certain to be named, and under a certain penalty, to be and appear in this Honorable Court, then and there to answer all and singular the premises and to stand by such further order, direction and decree as may be made in this behalf.

ECONOMY FUSE AND MANUFACTURING COMPANY,
By ALFRED L. EUSTICE,
President.

E. W. SHEPARD,
Solicitor for Plaintiff.
JAMES P. HUME,
Of Counsel for Plaintiff.
HENRY M. HUXLEY,
Of Counsel for Plaintiff.

STATE OF ILLINOIS,
County of Cook, ss:

Alfred L. Eustice, being duly sworn, deposes and says that he is President of Economy Fuse and Manufacturing Company, the plaintiff in the above-entitled cause; that he has read the foregoing Bill of Complaint and knows the contents thereof; that the same is true of his own knowledge except as to such matters as therein stated to be on information and belief, and as to those matters he believes it to be true.

ALFRED L. EUSTICE.

Subscribed and sworn to before me this 10th day of April, 1933.

[NOTARIAL SEAL.]

G. S. SCHLUNG,
Notary Public.

7 *Answer to the Bill of Complaint.*

Filed April 21, 1933.

* * * * * * *

T. A. Hostetler, Solicitor, U. S. Patent Office, for Defendant.

To the Honorable the Judges of the Supreme Court of the District of Columbia:

Thomas E. Robertson, Commissioner of Patents, defendant herein, in answer to the Bill of Complaint alleges on information and belief as follows:

He admits the allegations as to the status and residence of the parties to this suit and the allegation of jurisdiction under Section 4915 R. S.; 35 U. S. C. A. 63.

I. He has no informataion as to the allegation of invention made by Oscar A. Cherry and Franz Kurath except as informed by the Bill and by their application.

II. He admits that the said Oscar A. Cherry and Franz Kurath on the 21st day of January, 1929, filed an application for letters patent in the United States Patent Office, to which application Serial No. 334,132 was given.

III. He admits that the application was duly prosecuted before the primary examiner who, on January 15, 1932, finally rejected claims 8 to 13, inclusive, recited in paragraph III. Defendant denies that these claims are patentable to plaintiff as they are held to be unpatentable over the following prior patents, viz.:

8 Miller, 1,061,770, May 13, 1913,
Talley, 1,223,216, April 17, 1917,
Kempton, 1,513,323, Oct. 28, 1924,
Smith, 1,557,730, Oct. 30, 1925.

Profert of copies of these patents is hereby made.

IV. He admits that an appeal was taken from the decision of the Primary Examiner to the Board of Appeals and that the Board of Appeals in a decision rendered October 17, 1932, affirmed the decision of the Primary Examiner. A patent to plaintiff as assignee of the applicants was thereby refused.

V. He admits the allegation of assignment.

Further answering defendant denies that plaintiff is entitled to the allowance of the claims as more fully appears from the decision of the Examiner and the decision of the Board of Appeals and from the article on "Fillers", pages 378-380, in "Synthetic Resins and their Plastics", by Carleton Ellis, published by The Chemical Catalog Company, Inc., 19 East 24th Street, New York, N. Y. (copy in the Scientific Library of the United States Patent Office). Copies of said decisions and article on fillers will be presented at the hearing.

And further answering defendant denies each and every allegation of the Bill of Complaint not herein specifically and sufficiently denied or admitted, and prays that plaintiff's Bill of Complaint be dismissed.

Wherefore defendant having fully answer- the Bill of Complaint denies that plaintiff is entitled to the relief demanded or any part thereof and prays that he be hence dismissed with all costs of the proceedings against the plaintiff as provided in Section 4915 R. S.

THOMAS E. ROBERTSON,
Commissioner of Patents, Defendant.

T. A. HOSTETLER,
Solicitor of the U. S. Patent Office,
Attorney for Defendant.

9 DISTRICT OF COLUMBIA,
City of Washington, ss:

I, Thomas E. Robertson, Commissioner of Patents, depose and say that I have read the above answer by me subscribed and know the contents thereof, and that the statements of facts therein made as upon personal knowledge are true, and those made upon information and belief I believe to be true.

THOMAS E. ROBERTSON,
Commissioner of Patents.

Subscribed and sworn to before me this 20th day of April, 1933.

[NOTARIAL SEAL.] ALBERT W. KAISER,
Notary Public, D. C.

My commission expires March 21, 1938.

Memoranda.

July 31, 1933.—Order substituting Conway P. Coe, Commissioner of Patents as party defendant.

April 19, 1934.—Deposit for costs by E. W. Shepard.

Memorandum Opinion.

Filed Nov. 30, 1934.

* * * * * * *

I agree with the conclusions reached by the Board of Appeals of the Patent Office and the bill will be dismissed with costs.

BAILEY, *J.*

10

Findings of Fact.

Filed February 25, 1935.

* * * * * * *

1. Plaintiff's application discloses and claims a thermoplastic molding composition of resinous material having a filler therein consisting of relatively short lengths of spun fibrous material in string-like form.

2. The patent to Miller, 1,061,770, discloses a gear wheel composed of layers of textile fibers which are compressed and held together by side plates riveted together.

3. The patent to Talley, 1,223,216, discloses a molded machine element comprising a phenolic resin intimately mixed with fibrous materials, cotton, hemp or other textile fibers.

4. The patent to Kempton discloses a moldable phenolic condensation composition mixed with shreds of a coated and dried woven fabric.

5. The patent to Smith, 1,557,750, discloses a method of coating a yarn with a phenotic composition and molding the same in a tangled mass into various articles.

Conclusions of Law.

1. The claims are unpatentable over the prior art adduced by defendant.

2. The relatively short lengths of spun fibrous material selected by the applicant is but a change of form of the

fibers, woven fabric and tangles yarn of the prior art, the selection of which would be obvious to one skilled in this art.

11 3. Plaintiff is not entitled to an allowance of the claims and the Bill will be dismissed.

JENNINGS BAILEY,
Justice.

Final Decree.

Filed February 25, 1935.

* * * * * * *

This cause having come on to be heard and having been tried in open court and argued by counsel for the respective parties upon the pleadings and proofs adduced and submitted to the Court,

It is adjudged, ordered and decreed this 25th day of February, 1935, that the Bill of Complaint in this case be, and the same hereby is dismissed with costs against the plaintiff.

JENNINGS BAILEY,
Justice.

From the foregoing decree the plaintiff appeals to the United States Court of Appeals for the District of Columbia and the amount of the undertaking for costs on appeal is fixed at one hundred dollars or a cash deposit of $50.00.

JENNINGS BAILEY,
Justice.

Memorandum.

March 29, 1935.—$50 deposit in lieu of bond on appeal.

12 *Assignment of Errors.*

Filed June 19, 1935.

* * * * * * *

Now comes the plaintiff in the above-entitled cause, by its solicitor, and having taken an appeal to the Court of Appeals of the District of Columbia from the decree made and entered in this cause on the 14th and 15th day of November, 1934, says that said decree, the findings of fact and conclusions of law are erroneous, unjust and against the rights of said plaintiff, and as assignment of error therein represents that said Supreme Court of the District of Columbia erred in the following particulars:-

1. The Court erred in the statement relative to plaintiff's claims in paragraph 1 of the findings of fact, by failing to find that the plaintiff's material is stronger than any moldable material of the prior art.

2. The Court erred in the statement relative to plaintiff's claims in paragraph 1 of the findings of fact, by failing to find that plaintiff's material is moldable by commercial molding processes and that the products resulting therefrom have strength qualities rendering them suitable for use as heavy duty machine parts.

3. The Court erred in the statement relative to the plaintiff's claims in Paragraph 1 of the findings of fact, by failing to find that the plaintiff's invention is the first to produce a composition from which heavy duty machine parts can be made by molding operations.

4. The Court erred in the statement relative to the plaintiff's claims in paragraph 1 of the findings of fact, by failing to find that the upper limit of length of substantially two inches as specified in plaintiff's application for Letters
Patent is critical to the combined properties of maxi-
13 mum flow- ability of the material and strength of
the resulting products.

5. The Court erred in paragraph 2 of the findings of fact, by failing to find that the patent to Miller No. 1,061,770 is entirely irrelevant, impertinent and immaterial as an anticipating reference for the plaintiff's invention.

6. The Court erred in paragraph 3 of the findings of fact, by failing to find that the machine elements of Talley No. 1,223,216, is not sufficiently strong for use as heavy duty machine parts and that they are greatly interior in strength to articles produced from the plaintiff's material.

7. The Court erred in paragraph 4 of the findings of fact, by failing to find that the composition of the Kempton patent No. 1,513,323 produces articles which have insufficient strength for use as heavy duty machine parts and which possess strength characteristics greatly inferior to those produced by the plaintiff's material.

8. The Court erred in paragraphs 3 and 4, of the findings of fact, in failing to find that there is no teaching or sugges-

tion in the patents to Talley and/or Kempton as to how greater strength could be produced.

9. The Court erred in paragraphs 3 and 4 of the findings of fact, in failing to find that materials produced from the shortest lengths of string of the plaintiff's material are more flowable than the materials of Talley or Kempton.

10. The Court erred in paragraph 5 of the findings of fact, in failing to find that the material disclosed in the patent to Smith No. 1,557,570 is not flowable and cannot be molded by commercial molding operations.

11. The Court erred in paragraph 5 of the findings of
fact, in failing to find that the articles produced by
14 the materials disclosed in the Smith Patent No.
1,557,570 are inferior in transverse strength to the
articles produced from the plaintiff's materials.

12. The Court erred in paragraph 5 of the findings of fact, in failing to find that Smith's patent discloses only a mass of continuous uncut string and embodies no teaching or suggestion relative to cutting the same nor relative to any means or procedure which would increase the flowability thereof.

13. The Court erred in failing to find that the prior art patents of record either individually or collectively, do not teach or suggest the procedure and results constituting the plaintiff's invention.

14. The Court erred in failing to find that the prior art patents either individually or collectively, do not teach or suggest that the plaintiff's upper limit of string length is critical to the production of maximum strength and flowability of the material.

15. The Court erred in paragraph 1 of the conclusions of law in holding that the plaintiff's claims are unpatentable over the prior art adduced by defendant.

16. The Court erred in paragraph 2, of the conclusions of law in holding that the selection of relatively short lengths of spun fibrous material is but a change of form of the fibers, woven fabric and tangled yarn of the prior art, the selection of which would be obvious to one skilled in the art.

17. The Court erred in paragraph 2 of the conclusions of law in failing to hold that the present invention is productive of new and unexpected results which are not taught or suggested in the prior art patents considered individually

or collectively, and which constitutes a patentable invention.

15 18. The Court erred with respect to paragraph 3 of the conclusions of law in holding that the claims are unpatentable and that the plaintiff is not entitled to a patent thereon.

19. The Court erred in holding that the plaintiff is not entitled to a decree for the claims which have been refused by the tribunals of the Patent Office.

20. The Court erred in not granting the prayers of plaintiff's Bill of Complaint.

Wherefore, plaintiff prays that said decree be reversed, and that this case be remanded with instructions that the prayers in plaintiff's Bill of Complaint be granted.

EDWARD W. SHEPARD,
Solicitor for Plaintiff.

Service of the above Assignment of Errors and receipt of a copy thereof hereby acknowledged this 17th day of June, 1935.

R. F. WHITEHEAD,
Solicitor for Defendant.

Designation of Record.

Filed April 6, 1935.

* * * * * * *

Now comes the Plaintiff, Economy Fuse and Manufacturing Company, a Corporation, the Appellant in the above entitled cause, and designates the parts of the record which it desires to have included in the Transcript, said parts being considered sufficient for the determination of the questions raised on Appeal, namely:

1. Bill to enforce issue of patent.
2. Answer to bill of complaint.
16 3. Memorandum of substitution of defendant.
4. Memorandum of deposit for costs.
5. Plaintiff's Exhibit No. 1—certified copy of file wrapper and contents of Cherry and Kurath application for patent Serial No. 334,132.
6. Plaintiff's Exhibit No. 4—copy of patent to Cherry 1,896,070.
7. Plaintiff's Exhibit No. 5—chart entitled "Tensil-Strength and Flowability".

8. Plaintiff's Exhibit No. 6—chart entitled "Tranverse Strength and Flowability".

9. Plaintiff's Exhibit No. 7—chart entitled "Impact Resistance and Flowability".

10. Plaintiff's Exhibit No. 8—chart entitled "Flowability of Cherry-Kurath Material only slightly Effected by Modified Character of Binder and Ratio of Binder to Filler."

11. Plaintiff's Exhibit chart entitled "Effect on Strength of Length of Pieces of Filling Material".

12. Defendant's Exhibit A—Copy of patent to Miller 1,061,770.

13. Defendant's Exhibit B—Copy of patent to Talley 1,223,216.

14. Defendant's Exhibit C—Copy of patent to Kempton 1,513,323.

15. Defendant's Exhibit D—Copy of patent to Smith 1,557,730.

16. Defendant's Exhibit E—Article entitled "Fillers" by Carleton Ellis published in "Synthetic Resins and Their Plastics" by The Chemical Catalogue Company, Inc., Pages 378-380.

17. Defendant's Exhibit F—Examiner's Statement on appeal to Board of Appeals of Patent Office.

18. Defendant's Exhibit G—Examiner's Supplemental Statement on appeal to Board of Appeals of Patent Office.

17 19. Defendant's Exhibit H—Decision of Board of Appeals of Patent Office.

20. Memorandum Opinion of Mr. Justice Bailey.

21. Findings of Fact and Conclusions of Law.

22. Final Decree, notation of appeal in open court and order fixing bond for costs of appeal and cash deposit in lieu thereof.

23. Memorandum of deposit for costs on appeal.

24. Assignment of Error.

25. Statement of Evidence.

26. This Designation of Record.

E. W. SHEPARD,
Solicitor for Economy Fuse and Manufacturing Company, Plaintiff-Appellant.

April 6th, 1935.

Stipulation.

Filed April 6, 1935.

* * * * * * *

It is this 5th day of April, 1935, hereby stipulated and agreed by and between the parties hereto, by their respective Attorneys, that the Transcript on Appeal shall constitute those parts of the original proceedings as are set forth in the foregoing Designation of the Record, to which this Stipulation is attached; service and receipt of a copy of such Designation of the Record are hereby acknowledged by the Defendant.

E. W. SHEPARD,
Solicitor for Plaintiff-Appellant.
T. A. HOSTETLER,
Attorney for Defendant.

18 *Memorandum.*

June 19, 1935.—Statement of Evidence approved, signed and made of record.

19 Supreme Court of the District of Columbia.

UNITED STATES OF AMERICA,
District of Columbia, ss:

I, Frank E. Cunningham, Clerk of the Supreme Court of the District of Columbia, hereby certify the foregoing pages numbered from 1 to 18, both inclusive, to be a true and correct transcript of the record, according to directions of counsel herein filed, copy of which is made part of this transcript, in cause No. 55555 in Equity, wherein Economy Fuse and Manufacturing Company is Plaintiff and Thomas E. Robertson, Commissioner of Patents, is Defendant, as the same remains upon the files and of record in said Court.

In testimony whereof, I hereunto subscribe my name and affix the seal of said Court, at the City of Washington, in said District, this 29th day of June, 1935.

[Seal Supreme Court of the District of Columbia.]

FRANK E. CUNNINGHAM,
Clerk,
By CHAS. B. COFLIN,
Asst. Clerk.

20 In the Supreme Court of the District of Columbia.

In Equity.

No. 55,555.

ECONOMY FUSE & MANUFACTURING COMPANY

vs.

CONWAY P. COE.

Condensed Statement of Evidence.

Be it remembered that the above entitled cause came on for trial upon the issues framed by the pleadings, on Wednesday, November 14th, and Thursday, November 15th, 1934, Mr. Justice Jennings Bailey presiding, and thereupon the following proceedings were had, evidence offered and given, and rulings made by the Court:

The following exhibits were marked and received in evidence on behalf of the Plaintiff:

Plaintiff's Exhibit No. 1—certified copy of file wrapper and contents of Cherry and Kurath application for Patent, Serial No. 334,132.

Plaintiff's Exhibit No. 2—a gear.

Plaintiff's Exhibit No. 3—a push button of molded material.

Plaintiff's Exhibit No. 4—copy of patent to Cherry, No. 1,896,070.

Plaintiff's Exhibit No. 5—chart entitled "Tensile Strength and Flowability."

Plaintiff's Exhibit No. 6—chart entitled "Transverse Strength and Flowability."

21 Plaintiff's Exhibit No. 7—chart entitled "Impact Resistance and Flowability."

Plaintiff's Exhibit No. 8—chart entitled "Flowability of Cherry-Kurath Material Only Slightly Effected by Modified Character of Binder and Ratio of Binder to Filler."

Plaintiff's Exhibit No. 9—chart entitled "Effect on Strength of Length of Pieces of Filling Material."

The following exhibits were marked and received in evidence on behalf of the Defendant:

Defendant's Exhibit A—Copy of patent to Miller No. 1,061,770.

Defendant's Exhibit B—Copy of patent to Talley No. 1,223,216.

Defendant's Exhibit C—Copy of patent to Kempton No. 1,513,323.

Defendant's Exhibit D—Copy of patent to Smith No. 1,557,730.

Defendant's Exhibit E—Article entitled "Fillers" by Carleton Ellis published in "Synthetic Resins and Their Plastics" by The Chemical Catalogue Company, Inc., Pages 378-380.

Defendant's Exhibit F—Examiner's Statement on Appeal to Board of Appeals of Patent Office.

Defendant's Exhibit G—Examiner's Supplemental Statement on Appeal to Board of Appeals of Patent Office.

Defendant's Exhibit H—Decision of Board of Appeals of Patent Office.

22 Thereupon, to maintain the issue, plaintiff offered in evidence—

Oscar Allen Cherry, a witness for plaintiff, having been sworn, stated in substance:

Direct examination.

By Mr. Hume:

My name is Oscar Allen Cherry; my residence is Chicago, Illinois; my age is 39 years, my occupation is that of chemist.

I am now employed by The Glidden Company and formerly, during the period from 1925 until 1932, was employed by the Economy Fuse & Manufacturing Company, the plaintiff in this suit. I am the Oscar Cherry named as one of the joint applicants in the application in suit.

I was graduated with a degree of Bachelor of Science in Chemistry from the University of Illinois in 1920. I have been practicing my profession since that time.

Most and practically all of the time, with the exception of the past two years, has been in molded products, and my work has been connected with molded products. During the past two years it has still been with synthetic resin, but not primarily with molded products.

23 I have made inventions, in addition to this one, of molded products of resinous type. There are somewhere between fourteen and eighteen; I do not know the exact number. I am familiar with the manner of describing and claiming an invention in United States Letters Patents and I have read the patents cited in the record of this application and I believe I understand the disclosure set forth therein and feel that I can express an opinion as to those disclosures. I will now state, in my own language, what I regard my invention to be here. This description will be made in connection with the prior art as I knew it to exist at the time my invention was made. It seems to me the invention comprises the incorporation of the synthetic resin with this twine material or spun fiber, more technically speaking, together with the products derived from it. At the time that we made this discovery of the effect of using this twine-like material, there was no material out of which machine parts, such as gears, could be molded satisfactorily except, as Kempton has said, for the very lightest of service. That is to say, if we took the commonly known materials, such as the materials of Talley, the fiber materials, the unspun fibers, and if we used those, no matter what available length we used, we did not gain the strengths necessary for machine parts. If we used the canvas materials, of course that was well known, and it was known that you could make gears out of them, but only by a machining operation. At the time we made this discovery, it was also known to take this impregnated fabric, which was ordinarily used in forming sheets out of which gears were cut, and to take that material and chop it up into small pieces and mold it. But that would not give sufficient strength to mold a machine part such as a
24 gear. It would give increased strengths over the wood flour materials, and did supply a certain need, but did not go as far as was necessary to go, to mold this type of material—which we had hopes of doing.

The strength relationships attained by the macerated fabric that I just referred to, and that required for actual use as gears or other machine parts such as were accomplished by this invention are as follows: The wood-pulp material, the unspun fiber materials, such as we ordinarily used, were given transverse strengths of 10 and 12 thousand; the macerated fabric materials, transverse strengths of 12 to 15 thousand pounds; the canvas materials in sheet form, transverse strength of 20 to 25 thousand pounds. The impact strengths, however, in a relative sense can not be given in absolute figures, because there is no way of expressing impact resistance in absolute units. If we assign an impact resistance of two to wood flour, the macerated fabric material would have an impact resistance of possibly 10 to 15, or in that neighborhood, that is, the canvas materials in the macerated form; but the laminated materials would have an impact resistance, as I recall, in the neighborhood of 50.

By Mr. Hume:

Q. On the basis of 2 for wood flour? A. I am sorry, Mr. Hume; my memory on that is not exact.

Q. I just wanted to clarify the question and answer, because I had understood your initial premise was that if wood flour were 2—— A. Possibly that is a trifle high.

Q. Perhaps, Mr. Cherry, if in dealing with impacts you would state them in ratios, that one material is so many times stronger than another material, that would bring out the answer more clearly. A. That canvas material is about ten times stronger than the wood-flour material; and that, of course, would give me a lower figure.

Q. Laminated is ten times stronger than wood flour? A. That is correct; yes sir.

Q. Would you state what strength you get on impact with the materials of your invention compared with wood flour? A. In the same order; that is, about ten times. Possibly it would be a little higher, but not substantially higher.

Q. Will you state the ratio on impact between your material and Kempton's material? A. Kempton's material was substantially the same as that of macerated fabric. In other words, on this 2 basis, it would be from five to seven times as large as the wood flour material.

Q. Your invention would be five to seven times stronger than Kempton's product? A. No, sir; I did not say that. I said that Kempton's material was from five to seven times stronger than the wood flour materials, and that the string materials were about ten times as strong as wood flour materials. That would mean that the Kempton material was about one-half the strength, on impact resistance, of our materials.

26 I will now state what my understanding of the prior art was at the time I made this invention of using fillers for making molded products. As I understand the art, Talley had proposed and called attention to the fact that the increase in the length of fiber did give an increase in strength. That is the art followed by Kempton, who taught exactly the same thing. Kempton taught, however, that it was in practice a very difficult matter to take these long fibers—as, for instance, cotton batting, and to impregnate it with this resin solution, and then dry it out. It was difficult, as the material would tend to lump, but it would be difficult to get the solvent into the inside, and then those lumps were not of the proper form for charging into molds, and so you would have to cut them up, and so cut the length of the fibers.

So, as a matter of practical difficulty, as I understood Kempton's teachings, he thought that Talley had called attention to something that was an advance of the art, but he had not gone far enough in teaching its practice. So Kempton proposed, in attempting to obtain long fibers suitable for molding to impregnate a sheet of canvas with this resin material, and then shred it so as to reduce into its final form again. Thus he overcame the difficulties in this impregnation of the wads of fiber.

The Smith patent, of course, was in existence at the time he made this invention; and while for very simple shapes which did not require the material to flow during the pressing operation, it was suitable for molding. Yet there was no way of getting a usable piece out of it.

27 By Mr. Hume:

Q. Merely as an expert in this art, what would you say would be the best method of making the molded piece out of the Smith patent, and what would be the attendant thoughts accompanying that? A. I hardly understand your question. If you mean as to whether I would say, having the Smith process in front of me, how to go about to make the Smith process usable: Is that your question? I do not know. At the present moment, knowing what I do about the cut length of twine, why obviously I would know that the thing to do is to cut the Smith lengths up.

My idea of the disclosure of the Talley patent with regard to the length of fibers employed in the Talley reference is this: The Talley reference, as I understand it, simply taught that in place of the very fine powders which were in use at that time, that an increase of strength would be obtained if you used longer fibers up to the limit obtainable. The strengths of Talley would not be in any way comparable to the strengths obtained with my string. His strengths would be comparable with those obtained by Kempton. They would not be sufficiently high in magnitude to enable them to be used in gears and articles like that in heavy service.

My understanding of the Miller patent is that at that time, at the time Miller made his invention, there were in use gears made out of vulcanized fibers, which he calls indurated fibers; and he uses layers of leather, and so forth; and he called attention to the various defects that were encountered with the use of the material; and he conceived the idea of taking unspun fiber, such as cotton batting, and compressing that and then holding it in that com-
28 pressed condition by means of end plates which in
turn were held together by bolts or rivets; and so he thus kept the material that way without any binding material at all, as I understand the patent. It was necessary, then, to cut the teeth in that gear, after it had been molded, as the teeth could not be molded in under those conditions, of course.

The Miller gear has no binding material at all and, therefore, by "molded", I mean, compressed; simply a mass of it was compressed under pressure. It would not be compressed in all directions; only in one direction, as down. Of course, there is always a reactionary pressure up; but the pressure is down. On account of the fact, as Miller said, that the fibers are in frictional contact with each other, it could not be flowed sideways to form molded objects. As one illustration the Miller patent is merely a group of layers of cloth, he either took that mass of fibers and compressed them, or he took layers of cloth and piled them on top of each other, and compressed them and held them in that relationship by means of these end plates. This latter arrangement would be comparable to the leaves of a book compressed together by some mechanical means and held in place by means of end bolts. There is no binder that I can find used to hold it intact.

In my opinion, the Smith patent involves the use of a continuous piece of string. I do not find anywhere in the Smith patent any reference to cutting the strings, or using the string in smaller pieces. I do find, however, that he states that still another object of his invention is to provide a method whereby uncut flexible fibers, preferably organic, may be used and molded into such form as may be desired. That is, I see nothing, or no teaching whatsoever of cutting or of any advantages to be derived from cutting. I do not find any suggestions in Smith's patent as to how the flowability could be increased. I do not find any suggestion in the Kempton patent as to how a greater strength may be obtained, over that which was known to exist at the time of Kempton's invention, for relatively long unspun fibrous materials. 29

Insofar as the finished product and the quality of the fiber of the finished product is concerned, I would compare the products of Kempton with the products of Talley as being approximately equal, disregarding, for the comparison, the method of arriving at those products. They are similar. In other words, Kempton and Talley will give approximately equal results, because they are essentially the same thing. As I understand Kempton and Talley, Kempton is merely another method, and what he considers a practical method, of arriving at Talley's product.

Assuming that it is possible to get products which would be intermediate of the products of Kempton and the products of Smith, I will now explain my idea of the comparative properties of my product as compared with such intermediate products. The properties of our material are stronger than, and have greater strength than, anything intermediate between Kempton and Smith. In tensile strength we are substantially the same as Smith, and in no case do we go down as low as Kempton. In impact resistance, we are substantially the same as Smith, and in no case do we get down to Kempton, as there is no intermediate point that corresponds to any of our products. When you alter the character of the material by altering the length of the filler used so that the flowability of the

products is correspondingly influenced, that change
30 has an effect on strength. It tends to lower the
strength as the lengths are reduced, although there is not a straight line relationship. In other words, the strength is not directly proportional to the length. It goes down more gradually than that. The strength of a material will not increase, materially, for a corresponding increase in lengths of string material. I regard two inches as being critical. When you get the string longer than two inches in molded pieces, the pieces, if they are such as require flowing of the material to form them, simply do not fill out; that is to say, there will be portions of the piece that will be ragged and don ot have the material squeezed out into them, and consequently they are imperfect pieces and are useless. The flowability is impaired in lengths of string over two inches, in molding operations. Depending on the piece, the strength is also affected to some extent as the result of this imperfect flowability. That is to say, we could take an imperfect piece, if I were trying to mold a piece in a certain shape, and if a corner were imperfect, I could still test that piece in the middle and still obtain a very high strength. So, increasing the length of the string over two inches does not necessarily decrease the strength; it simply means an imperfect condition. The strength would not be affected at the region of imperfect formation in the portions of the mold that did happen to be down where flow had not been required to form them, and not compressed, as a rule. However, there would be a tendency for weak spots to be present. Weak spots—or, I should say, imperfectly filled-out parts—would result if
the string were too long. A gear that suffered in
31 its formation from this difficulty, would not be a
commercially usable gear because, if a tooth were imperfectly formed, obviously it would break off easily, as it would not be engaging properly in the meshing gear, and it would be subjected to strains greater than it could possibly stand; and it would be noisy and useless. In other words, where the flowability is affected to the extent that imperfect formation results, that imperfect formation obviously produces at those points an area of low strength.

The use of plasticizer in molding articles in accordance with my invention has very little effect at all, as it increases the flow of the resins somewhat, but it never increases it to

the point where it would make it possible to use greater lengths of string than we use at the present time. If I put string pieces, that I regard as too long, in a mold in combination with a more plastic resin, and endeavored to mold it in the usual way, the resin would be extruded from the mold. These molds obviously cannot fit air tight, and different parts must obviously slide within each other. So there is a clearance, usually, in commercial molds from two thousandths of an inch in the minimum to five thousandths of an inch in the maximum; and if we attempt to mold a piece from this long string that has the resin, as we call it, too soft—that is, too thermo-plastic—the resin will merely be extruded from these clearances around the mold; and the mold will have, depending in some instances upon the characteristics of the resin, poorly impregnated string strength. There is no resin there. This difficulty cannot
be altered by changing the quantity of the resin, so
32 long as you use string that is too long. I have not
been able to do it.

Regarding any of the various factors which are employed in molding, namely, temperature and mold pressure, fluidity of the resinous binder, relative proportions of the binder to filler, solvents, fillers, fluxes, or plasticizers, none of these can be employed for making what I regard as too long a string material, work satisfactorily.

When this invention was first produced by me and Mr. Kurath, and we made test pieces to determine the results, I expected to get something a little bit stronger than Kempton, but nothing approaching even the results that we did obtain. I did not expect to get flowability, but it just seemed to me that it was just a matter of trial that we really could not hope for much from it. I was amazed at the results that we did obtain.

I will now outline in a brief way some of the uses of my material, and name the kinds of articles that can be made from it. Outside of the one we have been talking about largely—gears—there are various parts, machine parts, that are now being produced out of laminated materials, by machine operations, which this material can replace much more cheaply, inasmuch as the machine operations are eliminated. One of them is a push-button for certain devices that operate by mechanical means, yet need to be electrical insulators, and that so far as I was aware, there has

been found no suitable material except laminated material, which must be subjected to machine operations. Another one is striker plates for automobile doors for which
33 at the present time they are using metal. But it would be extremely desirable to have a material which could be molded, on account of the silence, in closing the automobile doors. But, with the exception of our material, I know of none that will withstand the abuse to which that piece is subjected. We have molded experimentally such things, which have stood up perfectly satisfactorily in service. I do not know of any other material of this art which will produce the strengths which are obtained with our material, and which at the same time is moldable in the sense that this is moldable.

There is a difference between a finished article produced by molding and one which has been produced by being cut from a laminated piece of material. The molded article will have strength uniform in all directions, whereas the laminated products have very high strength across the laminations, but parallel with laminations it shears very easily, because in that particular case there are no fibers to be broken, but only the resin which has to be broken. Then, too, the molded object has this polished appearance as it comes from the mold, whereas, if it has to be machined, that finished appearance is destroyed and has to be restored if a polished appearance is necessary for the surface.

34 (Mr. Cherry was handed a gear and asked if he could identify it.)

This is a gear that I molded when conducting experimental work on this material. I cannot identify the exact time that I molded it, except that it was after we had made the initial tests on this type of material in the form of test bars, and so forth. I tested this particular gear for strength characteristics and, to the best of my recollection, the strength tests on this gear showed that it was about 10 per cent higher than a similar gear which we had purchased, made from laminated canvas material.

By the Court:

Q. What strength test did you use? A. This gear was put on to a shaft and held by means of this key. We provided a fixture which had the shape of a mating tooth, and set on one of these teeth, and then applied the load by means of a——

Q. I did not mean how you did it, but what was the nature of the test? A. The nature of the test was to determine the amount of load required to break one of these teeth. There are marks here which show——

Q. Is that what you have been referring to as the impact test? A. No, sir. This is not an impact test. This would be more in the nature of transverse strength, inasmuch as it is a gradually applied load rather than a suddenly applied load, as is the case with an impact test.

35 As to whether it is a standard and usual test, it is the only test that I know of that can be made, except at one place in the United States. There is only one machine that I know of in the United States which is capable of testing gears while running at high speeds. That is at the Massachusetts Institute of Technology. I made no tests on gears made from machined steel. However, on transverse strength of test specimens, the strength of this material is about the same as that of machined steel at elastic limit, that is, at the point where steel undergoes permanent deformation. If any material is subjected to a load it will deform slightly, if that load is not sufficient to rupture it, and the load is removed, the material will return to its normal position, except when it passes what is known as the elastic limit, in which case that deformation that is produced becomes permanent, and it is that point at which I am comparing the strength to steel. I do not know of any other moldable resinous product which would produce transverse strengths comparable to the strength of that gear.

I would like to clarify to some extent the relative strengths of the material of my invention with that of the material shown in the prior art. Yesterday I gave some information in this regard. In the first place, I mentioned something about macerated fabric, and then again I mentioned Kempton's material. There is a difference between the two which I will now explain. Macerated fabric, as I employed the term, simply meant chopped-up pieces of cloth which had been impregnated with resin, rather than the shredded material of Kempton cited in this case. I believe that Kempton is also the inventor of using the

chopped-up material, but I am not sure of that. But
36 if so, he was not cited in this case. As to strength characteristics, tensile strength, transverse strength, and impact strength, there is no substantial difference between macerated fabric and the shredded fabric of Kempton. In the file history of my application I filed an affidavit with the last amendment when the case was pending before the Patent Office and I conducted tests as stated in that affidavit and the results mentioned in that affidavit are true and correct. At the time I made this invention or, rather, just prior thereto, it was my opinion that the step of cutting Smith's continuous string into pieces would destroy the high strength benefits that he obtains with the method that he describes. It was definitely my opinion that that loss of strength would occur, and I was very much surprised to obtain the results I did obtain. It seemed to me natural to expect that cutting it into short lengths would result in a decrease in strength. There has been very little commercial development of my invention.

There have been some machine parts molded and sold, but not many. This is due to the fact that at the time that we had developed this material to the point where it was thought to be ready for the market, the economic conditions were such that the Economy Fuse and Manufacturing Company, who were the assignees, decided to temporarily abandon any and all hot molding. Hot molding is not their main business. Their main business is the manufacture of electrical fuses and this material is not necessary to fuses. As far as I know it has no application in fuses. It resulted in their deciding to stick to their main line and drop all side lines for the time being.

37 (A gear was marked Plaintiff's Exhibit No. 2 and received in evidence.)

(Mr. Cherry was handed a small molded piece and asked if he would identify it.)

This is a push button that was used by the Automatic Controller Company in a switch for use on printing presses, to be operated by mechanical means. This switch button is exposed to very severe impact in use. The switch is so arranged that at certain intervals it is released by a spring that imparts a considerable shock to the push button, the effect of which is to split it at this point (indicating) where the shoulder is. The Economy Fuse and Manufacturing Company received an order to supply these push buttons out of wood flour material, and they were purchased and attempted to be used, and found unsuitable on account of the fact that they did not possess the necessary shock resistance. There were efforts made to use vulcanized fiber, and I believe laminated material for this purpose, to actually machine them out, because, of course, they could not be molded. They were unsuccessful. At this time we were just developing this material, and we agreed to supply this particular company with these buttons made out of what I will call string material, for lack of a better term at the present moment, and we did so, and they proved perfectly satisfactory. In so far as I know that was the only material that was available to them. As far as my knowledge goes there is no other moldable material that gives this impact resistance.

By the Court:

Q. I notice that in that gear the threads are very distinctly visible. A. Yes, sir.

Q. But they are not in this. Why is that? A. One reason is in this case, your honor, that the string that was used was dyed black before it was impregnated. There
38 was also a black dye introduced into the resin.

Mr. Hume: These resins naturally, your Honor, can be made clear, and when so made the internal characteristics are visible. That also makes it possible to add dyes and produce all sorts of mottled effects and pleasant coloring effects. That is practiced commercially.

By Mr. Hume:

Q. Mr. Cherry, did you make that button? A. I can not say positively that I made this particular button. I made some like it. They are all so much alike that I can not pick out any particular one.

Buttons of this character were sold to this particular company and according to my recollection about 5 thousand were sold. They gave satisfactory service. There were no repeat orders during the time I was with the Economy Fuse and Manufacturing Company. My services terminated quite shortly thereafter.

(Push button of molded material was marked "Plaintiff's Exhibit No. 3" and received in evidence.)

I am familiar with a publication entitled "Synthetic Resins and Their Plastics," by Carleton Ellis, published by the Chemical Catalog Company, Incorporated, and am familiar with the disclosure contained on pages 378, 379 and 380, occurring under the sub-title "Fillers". I will now tell in a general way what is disclosed there: As I read Ellis, he simply tells what I have been talking about in regard to Talley, that where appearance and extreme moldability is the thing that is wanted, finely divided fillers, such as wood flour, are used. If fire resistance is desirable, and heat resistance, asbestos is used. There
39 are a number of troubles encountered when using asbestos fiber as a filler for a molded composition, inasmuch as it does not cover very well by the resin, and it tends to stick to the mold, so that it is difficult to get the pieces out of the mold. Mr. Ellis mentions the cotton flock and cotton linters. As far as my knowledge goes, those are not used to any appreciable extent with phenolic resins. They are used with shellac for molding to the extent that Mr. Ellis says, from two to five per cent to enchance the shock resistance, because when shellac is used as the resinous material, the fillers are quite commonly very finely divided minerals, such as whiting, sienna, ochre, and things of that nature, so that they tend to be very brittle, and this small proportion of cotton flock is introduced to help that shock resistance. It does not, even in that case, as far as my knowledge goes, bring the shock resistance up to what would be obtained had wood flour been used as the sole filling material. Silk flock, Mr. Ellis states, has been used in the manufacture of billiard balls, and for other purposes where mineral fillers are used, in articles requiring machining. I personally have had no experience with silk flock. I would expect it to be similar to cotton flock, except that Mr. Ellis states that it machines better than cotton flock. He also states that paper and canvas are used. We know that, of course. He also talks about the powdered fillers, such as mica, china clay, rotten stone, and so forth, that I have mentioned, which are commonly used with shellac. There is nothing there that in anywise suggests the use of string, or spun fibrous material in string-like form. There is nothing there to suggest that flowability could be realized

by using materials other than very finely divided materials.

40 It was the understanding in the trade at the time my invention was made that laminated material, or the continuous string of Smith, were the only ways of accomplishing the attainment of great strength, such as is obtained by my invention; except that I would qualify that to say that I do not believe that Smith was generally recognized as having any possibility of doing the things that can be done with laminated canvas. It was an understood fact that these strong materials would not flow so as to make moldable parts.

Mr. Hume: Your Honor, these pages in this book that the witness has just testified in connection with have been added to the answer by Mr. Hostetler, in addition to the references in the record, and they are included in that folder Mr. Hostetler has filed.

The Court: Very well.

(Mr. Cherry was handed a copy of a patent, one of the regular printed copies, No. 1,896,070, issued on February 7, 1933, and asked if the Oscar Cherry named there as inventor is himself.)

I am the inventor named there. This patent shows that a gear may be molded with the teeth formed in situ, so as not to require subsequent machining, from synthetic resin and relatively short lengths of spun, string-like material. The gear of this invention is made from the material which is the subject of this application. This patent is issued in my name as sole inventor, and the present application is an application filed by myself and one Kurath, jointly, because Mr. Kurath's connection with the company was terminated prior to the actual molding of this particular gear, and it was not realized, at the time we first discovered this particular material, that it was possible to mold gears

41 from it. I consider that I am the sole inventor of the invention of that patent and that I am a joint inventor with Mr. Kurath of the invention in suit. The scope of the claims allowed in that patent by the Patent Office, as I read them, is as follows: they are limited to a toothed gear with the teeth molded in situ, from the particular material we are discussing now, that is, the synthetic resin and the filler of relatively short pieces of fibrous spun ma-

terial. The description of the material employed for that gear is in substance the same language as the description of the material in the present invention.

I will now differentiate between the invention there and the invention here, so as to point out why I feel that I am entitled to further protection over and above the issued patent. This particular invention is limited to gears with the teeth molded in situ. It does not give any protection on molding a blank of the material, a disc, and subsequently cutting the teeth in. This invention, furthermore, from the nature of its language, as with the teeth molded in situ, is limited to what is known as spur teeth, that is to say, straight teeth. Now, practically all automobile gears use helical teeth. I have not been able to discover any way of successfully molding gears with that sort of teeth. They would have to be cut in after the blank had been molded, so, consequently, for that particular application, with helical teeth, this patent would give us no protection whatsoever. The issued patent does not cover any other kind of article other than gears, whereas the present invention is applicable to other articles.

(Copy of Cherry patent No. 1,896,070, was marked Plaintiff's Exhibit No. 4 and received in evidence.)

42 Cross-examination.

By Mr. Hostetler:

In exhibit 2, the gear wheel, and in exhibit 3, the push button, the molding material with which the binder is mixed, is called—short, string-like pieces. That is as good a name as I can give. There is no technical name that I know of. It is not bakelite. If you mean the resinous material, it is the reaction product of phenol and formaldehyde. Bakelite is a trade name covering resinous materials of that type produced by the Bakelite Corporation. It is not bakelite, because it was not produced by the Bakelite Corporation. It was produced by the Economy Fuse and Manufacturing Company. The binder is a phenol-formaldehyde resin.

Mr. Hume: I brought these bottles along merely as generally educational to all of us, so that we could see the subject-matter involved. If you want to introduce any of those, you are at perfect liberty to do so. It is easier to show some of these things than to try to describe them in words, that is all.

The purpose or advantage of having the filler of the particular length I use flows from the fact that we can get flowability together with strength at those particular lengths. In regard to the assumption that if the fibers or strings or fillers are too short they will not produce sufficient binding strength, we have made no tests shorter than one-eighth of an inch, since it seems rather impracticable to cut the string to any shorter length. At that point we do not obtain quite the strengths that we obtain with two inches. However, they are quite sufficient for a great number of needs. The
disadvantage in using the binders or fillers too long
43 would be that it would be impossible to mold perfect
pieces. In other words, what we call the flow of the material, which is another way of saying the moldability of the material, would not be sufficient to produce perfect pieces.

Q. Then, it is necessary, for whatever binder you use, that it shall be fluffy, and the threads must be of a substantial length. A. Mr. Hostetler, if I may, by "binder" you mean the string?

Q. Yes. A. That is the opposite to what we have been accustomed to call it.

Q. Yes. A. The string must be of substantial length, yes, sir.

Mr. Hostetler: May I ask whether you are going to leave these exhibits here?

Mr. Hume: I shall be delighted to, yes, sir.

By Mr. Hostetler:

Q. I have here a bottle that shows cords, apparently treated, in the shape of skeins of yarn, not tangled. If they were used as a filler, why would it produce a poor product, if it would? A. Because it simply would not flow out to fill an irregular piece, in other words, they would be lumpy. There would be points at which it would be cheesy, for lack of a better term. It would not have substantial strength. There would be other points that did have strength.

Q. I call your attention to the patent to Smith, 1,557,730, defendant's exhibit D. As I remember, counsel informed me that these exhibits having these skeins of thread represented the Smith filler.

44 Mr. Hume: I do not purport to say they represent it exactly. It is just illustrative, Mr. Hostetler, to visualize continuous string.

By Mr. Hostetler:

Q. On page 2 of that Smith patent, column 2, line 92, it says: "the impregnated yarn is packed indiscriminately, that is, in a tangled or haphazard condition, into the mold, so that one portion of yarn may be and is interlocked with another portion, the fibers thereof being thus interlocked and bound together." You would hardly call these cords representative of that description that I read, would you? A. They would be if they were packed indiscriminately into a mold. In this condition they are not packed that way. This is simply, as I see it, a length that you described as skeins of yarn. They would not be in a tangled, haphazard condition in that bottle.

With respect to the publication to which I referred a short time ago, and which is defendant's exhibit E, the article on fillers by Carleton Ellis, the paragraph marked "fillers", on page 378, line 15, refers to phenol-formaldehyde resins. That is the molding material that I use in my products. Page 379 of that same article, at the bottom of the page, refers to cotton flock and cotton linters. My definition or idea of what cotton flock and cotton linters are, is as follows: Cotton linters and flock, as I understand the term, is the small piece of cotton that adheres to the seeds when it is run through the particular machine or gin that gets the main bulk of the cotton off. It is the shorter lengths of the cotton. In that same paragraph, continuing on page 390, at the close of the paragraph is the text:

> "Cotton flock may be obtained in fibers of varying lengths. It has a great tendency to form small balls
> 45 or pellets when baled for shipment."

That paragraph indicates that before the filler is used for a binder, it must be fluffy, and not used when bunched up in balls, and further indicates that the fiber of the cotton flock should be straightened out.

Turning now to the patent to Miller, Defendant's Exhibit A, the gear shown in this patent was cut after the parts were pressed together.

Mr. Hostetler:

Q. You testified as to that patent yesterday, so it is not necessary to go into that patent further, other than to state that this patent was in litigation, as is reported in the Gazette.

The Court: You gave me the reference yesterday, 256 Federal 660.

Mr. Hume: That is correct.

Mr. Hostetler: If the Court please, I have a reprint of that in the Official Gazette.

Mr. Hume: Your Honor, it was just an infringement suit in which the validity of the Miller patent and the question of the infringement of the Miller patent was at issue; and there is no doubt but that it really has no bearing in this case, because here we have a question of the disclosure, and not the question of an infringement.

Mr. Hostetler: Mr. Hume's statement is correct. Of course, it was an infringement suit, suing an infringement on that patent.

Turning now to the patent to Talley, Exhibit B. At the bottom of the first page, in the last sentence, we find "If phenolic condensation products are used." That expression
"phenolic condensation products" is of the type that
46 is involved in this suit. Talley's patent contemplates
the use of cotton fibers that have not been spun, but
are just in their natural condition.

Turning now to the patent to Kempton, Exhibit C, 1,513,323, the second column, beginning with line 72:

"The primary object of my invention resides in the provision of a simple, economical and efficient method of providing a molding composition of the desired character in which the filler shall comprise undamaged, long fibers of cotton or other material."

In the next paragraph he refers to "woven fabric which may be shredded and chopped up, ground, or otherwise comminuted to provide a loose-flowing mass of long fibers". I would infer from this that Kempton confines himself to one particular filler, except in so far as he may use fabrics composed of different weavings; as, for instance, muslin or canvas—which, I believe, are the same except for the method of weaving and the size of yarn employed. They have a cotton base.

Redirect examination.

By Mr. Hume:

In answer to one of Mr. Hostetler's questions, I stated that if the string were too long, I would get portions that would not fill out and be properly molded. A condition of fiber length which is too long affects the arrangement of the fibers and their ability to become oriented in the mold. This is true from the results that are obtained, inasmuch as they simply do not flow out and fill out the piece properly. There is a strength benefit, in so far as strengths throughout the entire piece—that is to say, uniformity of
47 strength are realized, by having the pieces restricted in length to the magnitude described in my invention. In general we will get strengths substantially uniform in all directions; and of course, they give perfectly molded parts. The approximate lengths of the fibers that are referred to in the Talley and Kempton inventions, I know only from what I know of the art, as it would be my thought from reading them, that they are referring to fibers from possibly anywhere around one-sixteenth to possibly one-quarter of an inch, which possibly would be the maximum, except in the case of asbestos, where, as Talley points out, the asbestos fibers do tend to run into greater lengths.

Recross-examination.

By Mr. Hostetler:

It is true to some extent that it depends on the size of a mold. For instance, if you were molding an article the size and shape of a building brick, you could use much longer fibers than you could or would use in molding Exhibit No. 2, the push button. In that case I would, if I were molding that particular object described as a building brick, use my maximum length of fibers, but I would not go above it for the best result.

48 **Clarence A. Herbst**, a witness for plaintiff, having been sworn, stated in susbtance:

Direct examination.

By Mr. Hume:

Mr. Hume: Your Honor, so that you will understand our purpose, may I say that Mr. Cherry, having left the employ of the plaintiff, was unable to conduct the tests for the basis of this presentation; and Mr. Herbst, being a chemist still employed there, has conducted these tests.

The Court: Very well.

My name is Clarence A. Herbst. I am 34 years of age, and my residence is Park Ridge, Illinois. My occupation is as chemist for the Economy Fuse and Manufacturing Company, of Chicago, Illinois. I have been with the Economy Fuse and Manufacturing Company eleven and one-half years. My duties there are in the capacity of supervision of experimental work in the laboratory, and supervision of manufacture in the plant. My work involves the manufacture of resinous products. To a limited extent right now my work includes the production of hot-molding resinous products. I am familiar with the invention described in the Cherry-Kurath application involved in this suit and am familiar with the prior art references cited therein and believe I am qualified in the matter of understanding inventions as set forth in Letters Patent of the United States. I also believe I am capable of understanding those inventions and formulating opinions on them.

49 I graduated from the Armour Institute of Technology, of Chicago, with the degree of Bachelor of Science; and since that time I have devoted the first three or four years to laboratory development of plastic materials. Since that time I have been engaged in both development and manufacturing processes of plastic compositions. During the past three years the field of plastic compositions to which I refer includes the type of material involved in this invention. I believe I understand the inventions set forth in this application, and the references cited, and I have conducted tests in regard thereto.

(A tensile strength and flowability chart was handed to Mr. Herbst and he was asked if it represented results of tests conducted by him.)

This chart represents the results of tests conducted by me. I will now describe the significance of the points noted on this chart, and give an idea of how those tests were conducted, and what they mean. In producing the materials as outlined in the Cherry-Kurath application, we set about to impregnate a continuous length of spun fibrous material which we bought on the market as 4-ply cotton twine. This material was passed through a solution of a phenol formaldehyde resin in alcohol, passed through a chamber in which the air was heated to evaporate the alcohol, leaving as a result a continuous length of string impregnated with the phenol formaldehyde resin.

In accordance with the Cherry-Kurath application, which stated that the string is thereafter cut into relatively short lengths, we therefore set about to cut this string into lengths of one-eighth of an inch, one-quarter of an inch, one-half an inch, one inch, one and one-half inches, and two inches; and we left some of the string entirely uncut.

Here (indicating) is a point at the base of the green line, marked "Kempton fiber from muslin". I will now tell what that stands for, and why it was put there on that flowability and tensile strength chart. The Kempton patent was very carefully read, and we very carefully and diligently reproduced as closely as we knew that material, and molded that material in test specimens of a nature where we could produce the tensile strength of that particular composition. We also made what we know as a flow test of that same composition. This chart shows on the horizontal line the flow, which is a measure in grams per minute of a material which has extruded from an orifice of a die, said material being under pressure in that die. The vertical line in that chart represents the tensile strength, which is the resistance to pulling apart of test specimens made of that material. We found on testing the Kempton material that that flow registered approximately 26½ grams per minute. We also found that that same material resulted in a tensile strength of slightly over 6,000 pounds per square inch. That located a point represented at the lower end of the green line, which is designated as

Kempton fabric from muslin. The point marked "Kempton fabric from canvas" at the base of the blue line was determined in exactly the same way. The canvas material is slightly stronger than the muslin material, but is less flowable.

The point marked "Smith's continuous string" in the upper corner was determined in a similar way. So there we have a strength of approximately 15,000 pounds per square inch, and practically no flowability. The points which determine the character of the red line were determined in the same way. Therefore, we have, the point representing the string used in this invention, which is in the neighborhood of twice as flowable as Kempton's fiber from muslin.

51 Mr. Hume: Your Honor, do you mind my leading the witness? I think we can get along very fast this way.

The Court: I think the diagram explains itself, really.

Mr. Hume: Very well, your Honor; I shall be glad to pass that. I just wanted to be sure these points were understood. Then we shall pass to the next chart—after, however, if I may, introducing that as Plaintiff's Exhibit 5.

(Chart marked "Tensile Strength and Flowability" was thereupon marked Plaintiff's Exhibit 5 for identification, and was received in evidence.)

(Mr. Herbst's attention was next directed to a chart marked "transverse strength and flowability.")

This chart shows the results of tests conducted by me and it is an accurate representation of the results of those tests.

(Chart marked "Transverse Strength and Flowability" was thereupon marked "Plaintiff's Exhibit 6", for identification, and was received in evidence.)

(Mr. Herbst was shown another chart marked "Impact Resistance and Flowability", and asked if it likewise shows the results of tests conducted by him.)

It is an accurate showing.

(Chart marked "Impact Resistance and Flowability" was thereupon marked "Plaintiff's Exhibit 7", for identification, and was received in evidence.)

(Mr. Herbst's attention was next directed to a chart marked "Effect on strength of length of pieces of filling material", and asked if it represented the results of tests conducted by him.)

It does. It is an accurate representation of those tests, but I want to call your attention, your Honor, to a 52 correction in the lower figure there, representing the length of pieces of filling material as compared with transverse strength. Instead of 1,000, that should be 10,000; and in place of 2,000, that should represent 20,000.

Mr. Hume: In the very bottom.

By the Court:

Q. The figures at the bottom of each of those charts represent length in inches of the fibers of the string? A. Yes, sir.

The Court: Very well.

The general nature and purpose of this comparative chart of transverse, impact, and tensile strength is as follows: Transverse, impact, and tensile strengths of materials produced in accordance with the application of Cherry and Kurath were determined on lengths of strings of one-quarter of an inch, one-half an inch, one inch, two inches, five inches and, finally on continuous lengths. It is very markedly apparent that the transverse strength and the impact resistance and the tensile strength make a very decided increase between the lengths of one-quarter of an inch and two inches. During the conducting of these experiments, it was very much of a surprise to note the very decided increase from that very narrow range of one-quarter of an inch to two inches, as compared with the strength properties beyond a length of two inches.

On the portion of the chart marked "tensile strength" it may be noted from the point which lies in the red line and on the two-inch vertical line position that the increase in strength from there on, all the way to the point marked "Smith", is very slight indeed. Most of the strength properties are realized in the progression of lengths up to two inches. Likewise, on the impact resistance portion of the chart, I have recorded almost the maximum im- 53 pact at the point of about one inch. In the bottommost of the three lines of the scale showing transverse strength, the line declines to the right of the mark over the two-inch length indication. In other words, we have seen that the line rises and, then as it continues, it dips. My explanation of that characteristic is that in molding these pieces, where we have lengths of five inches, as shown there, the material does not uniformly orient itself throughout the entire mold, which would give sections of greater density, and other sections of less density, naturally influencing the strength of these materials. My tests showed that the transverse strengths of molded articles employing particles of string of two inches, as shown on the chart, were actually greater than the strengths of continuous string pieces of Smith. In other words, I got a strength in the pieces two inches long that is not capable of being produced by pieces longer than two inches.

I will now explain the blue dotted line in each case and explain why there is a break to the right side of the chart. In producing a test specimen in which the impact resistance, for instance, of the transverse strength and tensile strength is measured, we found that it took approximately 181 feet of continuous string to make a test specimen. If we carried that off on a piece of paper, we would probably have a chart 181 feet in length, which was ridiculous, from the standpoint of demonstration. We, therefore, got the line showing the properties in there at the end of a little over ten inches, and established the point of Smith a little farther on. That is the reason for the fracture in the red lines showing these physical properties.

54 I will now explain what the blue line is, and why it is inclined in the manner shown, and why, at the end of this space here (indicating), it continues in the manner shown, up to join the red line at the point marked "Smith". That blue line represents, in my opinion, the properties of materials which are visualized as intermediate between the process outlined by Kempton and the process outlined by Smith. These blue horizontal lines show only very slight inclination, because they represent the inclination which would be shown if this piece of paper were 181 feet long, and a straight line was drawn between the point zero at Kempton and the maximum strength of Smith.

(The chart marked "Effect on Strength of Length of Pieces of Filling Material" was here introduced but its introduction and marking was not reported in the Record. It has been entered by stipulation as Plaintiff's Exhibit 9.)

(Mr. Herbst was handed another chart marked "Flowability of Cherry-Kurath Material only slightly affected by character of binder and ratio of binder to filler".)

This chart represents results of tests conducted by me and it is an accurate showing of those tests. In the upper panel we have a showing marked "No Filler or Binder" and then a red line. The thing that is shown by comparing these five charts relative to each other is that changes of proportion of binder to filler, or changes in the amount of plasticizer of the resin, or various amounts of plasticizer in the resin, absence of plasticizer in the resin, or greatly increased amounts of plasticizer in the resin, have no decided effect upon the strengths or upon the flowability of a material whose filler is recognized as a spun fibrous material.

By the Court:

Q. What is meant by a "plasticizer"? A. A plasticizer is a substance which offers more flowability or plasticizing properties to a resin. That is, that phenol formaldehyde resin, as it is exhibited there, is somewhat brittle. That brittleness can be reduced somewhat by adding such materials as, for instance, waxes, which are considerably more plastic than a material such as a resin; and it is recognized in the trade that small amounts of such materials are conveniently added to offer softness, if I may put it that way, to the phenol formaldehyde resin.

Mr. Hume: Not ultimate softness, if I may add, but softness in the mold.

At the top, the red line extends to 30; and the second extends to 90; the third to 50; and the fourth to 50; and the final one goes to between 60 and 70, those varying to some extent as indicated by the numerical value.

In explanation it is recognized in plastic compositions that various plasticizers of different natures offer different properties of plasticizing to the resin itself. For instance, a wax has a different plasticizing effect, or softening effect, than has a liquid material commonly used, Butyl Stearate. This chart shows great similarity, irrespective of conditions, because the plasticizing agents do not govern the flow of a material to the extent to produce this very great drop in the flowability of this material, as shown in the drops of these red lines in each one of these charts. The characteristic of each one of these charts that indicate the similarity that I mentioned is that the flowability of these compositions drops from a maximum to a minimum within the range of approximately one-eighth of an inch to two inches in length of the string.

(Chart marked "Flowability of Cherry-Kurath material only slightly affected by character of binder and ratio of binder to filler" was thereupon offered as "Plaintiff's Exhibit No. 8" for identification, and was received in evidence.)

56 (Mr. Herbst's attention was called to Plaintiff's Exhibit No. 3, and was asked if the Economy Fuse and Manufacturing Company ever made that product.)

They did produce these parts. I know it has made them in accordance with the teachings of this invention. I have made them and the Economy Company has sold these parts commercially. We sold a lot of these after Mr. Cherry left the employ of the Economy Company to the Automatic Controller Company and some had been sold to them prior to the time Mr. Cherry left the Economy Company. We were in the commercial production of hot molded products at that time and we were making articles of this kind. The Automatic Controller Company came to us and gave us their impression that they would be very much disappointed if they were unable to get these parts from us, because they would not know where to locate a suitable and similar material for this device, so we filled the order. As I recall we sold 2,000 parts on this order.

Cross-examination.

By Mr. Hostetler:

In making these tests at the various speeds at which the material oozed through the perforation, I believe the speeds were governed largely by the resistance offered by the threads of the filler. The flow would vary somewhat as the threads went through, for the reason that the phenol formaldehyde resin is a thermo-setting material; and as the pressure was first brought about, heat and pressure,

the material was reasonably soft as compared to after the pressure had been on there for two or three minutes. In other words, this material gets harder as the process continues. We have two openings or perforations in
57 the apparatus, through which the material flowed. The amount of material was substantially equal in the two openings. The openings themselves were of the same size.

Redirect examination.

By Mr. Hume:

I stated that the extrusion of these materials on a flow test varied, and I then stated, that was due to the fact that the resinous materials were thermo-setting, and therefore they become harder the longer they are exposed to the heat of the mold, I mean by this that the variation gradually diminishes, due to the hardening of the resinous material. The binder and the filler both pass through, uniformly together. On these charts showing a tensile transverse and impact strength, I have shown the flowability of the Cherry-Kurath material as being almost twice that of the Kempton fiber from muslin. It is to be understood that the material of this invention, with string lengths of one-eighth of an inch, flowed through this small orifice, string pieces, binder and all, more fluidly and rapidly than did the string pieces and binder of Kempton and, as represented on that chart, about twice as fast.

Recross-examination.

By Mr. Hostetler:

I did not ever make any tests with hemp as a filler instead of cotton goods.

58 Plaintiff rests.

Defendant presented no witnesses, but at this time offered in evidence certain exhibits which were received in evidence and marked Defendant's Exhibits A to H inclusive as set forth on page 17 of this Statement.

Defendant rests.

Whereupon the trial of the foregoing case was concluded.

Be it further remembered that the foregoing, together with the exhibits appended hereto, contains the substance of all the evidence given at the hearing of this cause, and is approved, signed and ordered to be made of record in the above entitled cause this the 19th day of June, 1935.

JENNINGS BAILEY,
Justice.

It is stipulated and agreed that the Statement of Evidence as prepared and filed by the Plaintiff, service and receipt of a copy of which are acknowledged by the defendant, shall constitute the Statement of Evidence for the purposes of this appeal, and that the same may be received without further amendment, defendant hereby consenting to the immediate approval of said Statement of Evidence by the court and hereby waiving the period allowed under the rules in which to make objection and/or present amendments.

EDWARD W. SHEPARD,
Solicitor for Plaintiff-Appellant.
R. F. WHITEHEAD,
Solicitor for Defendant.

59 In the Supreme Court of the District of Columbia.

In Equity.

No. 55,555.

ECONOMY FUSE & MANUFACTURING COMPANY

vs.

CONWAY P. COE.

Stipulation of Exhibits.

It is, this 17th day of June, 1935, hereby stipulated and agreed by and between the parties hereto, through their respective solicitors, that the following mentioned paper exhibits, which were offered in evidence during the trial of this cause, shall be attached to and made, and considered to be a part of the Statement of Evidence for the appellant, and shall be treated as having been incorporated in said Statement of Evidence. The papers are as follows:

1. Plaintiff's Exhibit No. 1—certified copy of file wrapper and contents of Cherry and Kurath application for patent Serial No. 334,132.

2. Plaintiff's Exhibit No. 4—copy of patent to Cherry No. 1,896,070.

3. Plaintiff's Exhibit No. 5—chart entitled “Tensile Strength and Flowability”.

4. Plaintiff's Exhibit No. 6—chart entitled “Transverse Strength and Flowability”.

5. Plaintiff's Exhibit No. 7—chart entitled “Impact Resistance and Flowability”.

6. Plaintiff's Exhibit No. 8—chart entitled “Flowability of Cherry-Kurath Material only Slightly *E*ffected by Modified Character of Binder and Ratio of Binder to Filler.”

60 7. Plaintiff's Exhibit No. 9—chart entitled “Effect on Strength of Length of Pieces of Filling Material.”

8. Defendant's Exhibit A—Copy of patent to Miller 1,061,770.

9. Defendant's Exhibit B—Copy of patent to Talley 1,223,216.

10. Defendant's Exhibit C—Copy of patent to Kempton 1,513,323.

11. Defendant's Exhibit D—Copy of patent to Smith 1,557,730.

12. Defendant's Exhibit E—Article entitled “Fillers” by Carleton Ellis published in “Synthetic Resins and Their Plastics” by The Chemical Catalogue Company, Inc., Pages 378-380.

13. Defendant's Exhibit F—Examiner's Statement on appeal to Board of Appeals of Patent Office.

14. Defendant's Exhibit G—Examiner's Supplemental Statement on appeal to Board of Appeals of Patent Office.

15. Defendant's Exhibit H—Decision of Board of Appeals of Patent Office.

EDWARD W. SHEPARD,
Solicitor for Plaintiff.
R. F. WHITEHEAD,
Solicitor for Defendant.

61 PLTFF'S EX. 1.

390.

Department of Commerce, United States Patent Office.

To all persons to whom these presents shall come, Greeting:

This is to certify that the annexed is a true copy from the records of this office of the File Wrapper and Contents, in the matter of the Pending Application of Oscar A. Cherry and Franz Kurath, Filed January 21, 1929, Serial Number 334,132, for Improvement in Moldable Composition of Matter and Process for Producing Same.

In testimony whereof I have hereunto set my hand and caused the seal of the Patent Office to be affixed, at the City of Washington, this fifteenth day of October, in the year of our Lord one thousand nine hundred and thirty-four and of the Independence of the United States of America the one hundred and fifty-ninth.

[Seal Patent Office United States of America.]

CONWAY P. COE,
Commissioner of Patents.

Attest:
D. E. WILSON,
Chief of Division.

(Here follow photolithographs, side folios 62, 63.)

64 This invention relates to thermoplastic compositions of matter and particularly to compositions capable of being molded under heat and pressure to form objects of irregular and varied shapes. More particularly this invention relates to thermoplastic composition having a binder of reactive resinous

1/2/29 28684 4854

NUMBER (Series of 1925)
334182

PATENT NO.

1929

DATED

DIV.: 50

(EX'R'S BOOK) 19-2
7

Division of App., No. ______, *filed* ______, *19*__

Name OSCAR A. CHERRY AND FRANZ KURATH
Assor to Economy Fuse and Manufacturing Company, of Chicago, Ill., a corp. of New York.

of CHICAGO
State of ILLINOIS
Invention MOLDABLE COMPOSITION OF MATTER AND PROCESS FOR PRODUCING SAME

ORIGINAL	**RENEWED**
APPLICATION FILED COMPLETE JAN 21, *1929*	
PARTS OF APPLICATION FILED *Petition, Specification, Oath, First Fee $20,* ___ ~~*sheets*~~ *Drawings,* JAN 21, *1929*	
Examined and passed for Issue ______, *192*	*Reexam'd and passed for Issue* ______, *192*
______ *Exr. Div.* ______	______ *Exr. Div.* ______
Notice of Allowance ______, *192* *By Commissioner.*	*Notice of Allowance* ______, *192* *By Commissioner.*
Final Fee ______, *192*	*Final Fee* ______, *192*

Attorney WILKINSON, HUXLEY, BYRON & KNIGHT FIRST NATIONAL BANK BLDG
CHICAGO ILL

Associate Attorney ______

No. of Claims Allowed ______ *Print Claims* ______ *in O. G. Class* ______

Title as Allowed ______

31—6826

A

PETITION

(Case No. 28,684)

TO THE COMMISSIONER OF PATENTS:

2 RECD JAN 21 1929 U.S. PAT. OFF.

Your petitioners, OSCAR A. CHERRY and FRANZ KURATH, citizens of the United States and residents, respectively, of Chicago, in the County of Cook, and State of Illinois, and of Chicago, in the County of Cook, and State of Illinois, whose post-office addresses are, respectively, c/o Economy Fuse & Mfg. Co. 2717 Greenview Ave., Chicago, Illinois and Economy Fuse & Mfg. Co., 2717 Greenview Ave., Chicago, Illinois. pray that Letters Patent may be granted to them for the Improvements in MOLDABLE COMPOSITION OF MATTER AND PROCESS FOR PRODUCING SAME set forth in the annexed specification; and they hereby appoint WILKINSON, HUXLEY, BYRON & KNIGHT, a firm consisting of George L. Wilkinson, Henry M. Huxley, Charles L. Byron, Hervey S. Knight, Milton T. Miller, Howard W. Hodgkins and Ralph Munden, First National Bank Building, Chicago, Illinois, (Registration No. 11,282), their attorneys, with full power of substitution and revocation, to prosecute this application, to make alterations and amendments therein, to receive the patent, and to transact all business in the Patent Office connected therewith.

Signed at Chicago, Illinois, this 17th day of January, 1929.

Oscar A. Cherry
Franz Kurath

SPECIFICATION

TO ALL WHOM IT MAY CONCERN:

Be it known that we, OSCAR A. CHERRY and FRANZ KURATH, citizens of the United States, residing, respectively, at Chicago, in the County of Cook, and State of Illinois, and at Chicago in the County of Cook, and State of Illinois, have jointly invented certain new and useful improvements in MOLDABLE COMPOSITION OF MATTER AND PROCESS FOR PRODUCING SAME. of which the following is a specification:

material and a filler containing pieces of a string-like material as an essential ingredient. The invention also relates to the finished molded articles produced from the above mentioned thermoplastic composition of matter and to a process of producing the thermoplastic composition of matter and the finished molded articles from the thermoplastic composition of matter.

This invention is illustrated as embodied in a composition of matter comprising a thermoplastic reactive phenol-aldehyde resin and a filling material of yarn or string.

It has been well known in this art that articles may be formed by molding various artificial resins with fillers incorporated therein. The resins have usually been compounds of phenol or its homologues and aldehydes such as formaldehyde or its polymers. The practice has been to produce the resinous substance to the point where it is potentially reactive and in this condition and with appropriate fillers incorporated therewith, to mold articles therefrom by the application of heat and pressure.

In instances where an actual flowing of the material is required in producing the article, as distinguished from a mere pressing operation, the selection of fillers has been limited to those of finely divided character and for the most part, have been wood flour, asbestos or substances similar in consistency. Articles having incorporated therein, fillers of this character, have possessed certain good properties slightly varying according to the nature of the filler.

More recently it has been proposed to employ small scraps of cloth of any desired kind, such as linen, cotton or canvas, usually cut into small irregular fragments as a filling material for the moldable resins. By actual test, molded objects made in accordance with this latter method are found to have approximately the same tensile strength and modulus of rupture as similar articles molded from compositions having wood flour as a filling material but are found to possess a resistance to fracture by blows of from 5 to 7 times greater than similar objects made with wood flour. This characteristic is of material importance and is quite unexpected and its advantages have been realized only after an additional unexpected discovery, namely, that a binder composed of scraps of cloth material incorporated with moldable resin, is flowable to an extent rendering it serviceable for use in molding articles of irregular and varied shapes.

Such products have numerous defects, one of which is that it is impossible to obtain thereby, molded objects in which pieces of fabric do not show up in the finished molded articles, presenting irregular patches of contrasting color or appearance.

It has further been proposed to produce laminated products made from sheets of paper or textile fabric impregnated or coated with a reactive phenol-aldehyde condensation product. Products so made, are found to be mechanically strong having resistance to fracture by blows, being in this latter respect, far superior to ordinary commercial molded objects appearing on the market. However, articles made in accordance with this process, cannot be molded to intricate or irregular shapes.

Accordingly, it is an object of the present invention to produce a novel, thermoplastic composition which is free from the above objections and one which is heat setting and 66 thermoplastic in character having excellent flowing qualities in the mold, and produces articles which present a uniform. pleasing appearance having increased mechanical strength.

Another object is to provide an economical method by which thermoplastic composition contemplated in this invention may be produced and by which final articles may be produced from the thermoplastic composition.

Another object is to provide novel articles of manufacture having improved properties, such as high mechanical strength, particularly resistance to fracture by impact.

Accordingly, the present invention is illustrated by the process which consists in impregnating or coating yarn, such as cotton twine with a potentially reactive phenolic condensation product and thereafter cutting the twine into short lengths where-

by a molding composition having a high degree of
thermoplastic
Insert A′. flow is obtained. ^
A′

It has been found that when the composition so prepared is molded under appropriate conditions of heat and pressure that objects having a very high mechanical strength are obtained. Objects so formed are found to have a tensile strength and modulus of rupture at least 50 per cent greater than similar objects having a wood flour as filler material. The resistance to fracture by blows is found to be from 10 to 15 times greater than that of similar objects, having a wood flour as a filling material. This increase in tensile strength is surprising and unexpected, it being so much greater than would be indicated by the difference in the selections of filling material alone.

Products so formed are found to possess a uniform, pleasing appearance in addition to its characteristics of mechanical strength. Also the composition is found to possess good

67 flowing qualities such as renders it suitable for use in molding objects of irregular and varied shapes.

The inventors are aware that it has been proposed prior to this invention, to coat or impregnate twine with a phenolic varnish and to cram the uncut twine into molds and to consolidate the material under heat and pressure. Such a process however, does not produce a composition having any degree of plastic flow and in practice, is limited practically for use in the formation of those objects capable of being produced by compression only rather than by flowing material in a mold.

The prior art practice in this particular is quite similar to the method employed for producing laminated sheets in that the continuous twine or cord filler behaves in a manner similar to the sheets of fabric. In both instances, the process is only one where pressure can be employed without possibility of flowing the composition for the purpose of shaping by molding.

It is to be understood in connection with this invention, that any heat setting resin is suitable for practice but that it is preferable to use a potential reactive phenol-aldehyde condensation product. Any known method of coating or impregnating the yarn may be used but it is found preferable to draw the twine through a bath containing the preferred binder in solution in a suitable solvent. Such solutions or varnishes are well known in the art.

For the purposes of this illustration, 4-ply cotton yarn has been used, but it is to be understood that all yarn or similar materials are suitable to varying extents. In claiming this invention, the filling material is referred to as pieces of string-like material, it being the intention to include in this expression, all materials of string-like nature, such as for

68 example, yarns, threads, cords and twines of either organic or

mineral materials. The essential feature is to provide a filler of string-like characteristics without limiting the invention to any particular lengths of pieces, or thickness of materials, provided only that the filling material behave in the manner taught in this invention.

In producing the composition, after the coating or impregnating operation, the yarn is submitted to a gentle drying treatment, to free it from solvent and it is then cut into small lengths, preferably in lengths of about one inch. It is to be understood however, in this connection, that this invention is not limited to any particular lengths, the invention contemplating any and all lengths, such as will serve to produce the desired properties without destroying the flowable property of the composition.

In actual experiment, yarn or twine has been employed in lengths as short as one-eighth of an inch, it being found that with this length, although the impact resistance is somewhat less than with the longer lengths, such as one-half inch, for instance, it is still surprisingly in excess of the impact resistance produced by wood flour as a filling material, or other similar, granular, powdered or finely divided filling materials. The flowable characteristic of the material is increased as the length of the filling material is decreased, but it has been found by actual test, that a good, moldable material is provided when the length

WE CLAIM:

1. A thermoplastic molding composition comprising a binder of thermoplastic reactive resin and filling material of pieces of string-like material.

2. A thermoplastic molding composition comprising a thermoplastic reactive resin and pieces of fibrous string-like material.

Int a^2

3. A thermoplastic molding composition comprising a thermoplastic reactive resin and relatively short pieces of fibrous string-like material.

4. A thermoplastic molding composition comprising a thermoplastic reactive resin and pieces of fibrous string-like material of length less than approximately two inches.

5. The process which consists in coating continuous lengths of string-like material with a solution of a reactive thermoplastic resin, drying the coated material, cutting the coated material into relatively short lengths and molding the material so produced under heat and pressure.

6. A molded article of manufacture, comprising a filler of pieces of string-like material and are insoluble and infusible resinous material formed in situ.

7. A molded article of manufacture, comprising an insoluble and infusible resin and a filler of pieces of string-like material, having high resistance to fracture by impact.

Signed at Chicago, Illinois,

this 17th day of January, 1929.

Oscar A. Cherry

Franz Kurath

OATH

STATE OF ILLINOIS)
)ss.
COUNTY OF COOK)

OSCAR A. CHERRY and FRANZ KURATH, the above-named petitioners, being duly sworn, depose and say that they are citizens of the United States and residents, respectively, of Chicago in the County of Cook, and State of Illinois, and of Chicago in the County of Cook, and State of Illinois; that they verily believe themselves to be the original, first, and joint inventors of the Improvements in MOLDABLE COMPOSITION OF MATTER AND PROCESS FOR PRODUCING SAME, described and claimed in the annexed specification; that they do not know and do not believe that the same were ever known or used before their invention or discovery thereof; or patented or described in any printed publication in any country before their invention or discovery thereof, or more than two years prior to this application, or in public use or on sale in the United States for more than two years prior to this application; that said invention has not been patented in any country foreign to the United States on an application filed by them or their legal representatives or assigns more than twelve months before this application; and that no application for patent on said improvements has been filed by them or their representatives or assigns in any country foreign to the United States.

Oscar A. Cherry

Franz Kurath

Subscribed and sworn to before me this 17th day of January, 1929.

Notary Public.

9

Div. 50 Room 322

Address only
"The Commissioner of Patents,
Washington, D. C.,"
and not any official by name

IX/R

DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE
WASHINGTON

Paper No. 2

All communications respecting this application should give the serial numbe date of filing, and name of the applicant

MAILED
SEP 13 1929

Please find below a communication from the EXAMINER in charge of this application.

Thomas E. Robertson
Commissioner of Patents.

GPO 11—8023

Wilkinson, Huxley, Byron &
Knight,
1st Nat'l Bank Bldg.,
Chicago, Ill.

Applicant: O. A. Cherry et al,

Ser. No. 334,132
Filed Jan. 21, 1929
ForMoldable Composition of
Matter etc.

References made of record:

Smith,	1,557,730	Oct. 20, 1925	106-22C
Miller,	1,061,770	May 13, 1913	"
Kempton,	1,513,323	Oct. 28, 1924	"

The claims are all rejected as anticipated by Smith cited above. The cutting of the yarn into "relatively short pieces" whereas applicants state "this invention is not limited to any particular lengths" etc. (page 5, lines 11 to 15) is not considered a patentable distinction.

C. L. Blake
Examiner.

See 1,223,216

p1

of material such as 4-ply yarn for instance, is as great as one and one half inches. The tests have led to the belief that the composition would be suitable for molding with materials of greater length than one and one-half inches, but that the plasticity decreases rapidly for increase in lengths above one and one-half inches.

69 If desired, various lubricants, dyes and plasticizers may be used in connection with the practice of this invention. Also if desired, dyed yarn may be employed whereby various decorative effects may be obtained, by choosing variously colored yarn.

(Here follow photolithographs, side folios 70-72.)

73 [Stamp:] Mail Division, U. S. Patent Office. Mar. 13, '30.

[Stamp:] U. S. Patent Office, Division 50. Filed Mar. 14, 1930.

Letter #3.

(Case No. 28,684.)

In the United States Patent Office.

Division 50, Room 322.

In re Application of Oscar A. Cherry and Franz Kurath. Moldable Composition of Matter and Process for Producing Same. Serial No. 334,132. Filed January 21, 1929.

Amendment.

Hon. Commissioner of Patents,
Washington, D. C.

SIR:

In response to the Official Action of September 13th, 1929, a reconsideration of the claims as now presented, is respectfully asked for.

The three references have been carefully considered and it is not seen that they have any bearing on the applicants' invention inasmuch as they merely disclose processes and articles which the applicants admit are old in the introductory statements in their specification. The citation of these patents adds nothing new to the record.

In the Official Action, the Examiner states, with particular reference to the Smith Patent, that it would not involve invention to supply the string cut in short pieces. However, the applicants contend that this constitutes invention as a teaching for producing molded objects of the same strength as those obtained in the Smith patent. The fact of the matter is that the molded material made up in accordance with the Smith specification does not possess a high degree of flowability such as will enable the formation of objects having varied and irregular shapes such that portions thereof can only be produced by the free flowing of material in the mold.

74 It would not be expected by anyone skilled in the art, that the same degree of strength could be realized with the string-like filling material cut in pieces as described in the applicants' specification and yet by actual test, this is found to be the fact. It is only through the applicants' discovery that articles have been obtained having the combined properties of flowability and strength characteristic of the claimed articles.

It is noted that the Examiner states that Page 5, lines 11 to 15 of the specification, indicate that the particular length of the string is not important, but the Examiner is requested to consider the last part of the statement referred to where it is provided the lengths must be such as to produce the advantages set forth in the described invention.

It is the applicants' discovery that these string pieces produce the advantages of combined strength and flowability and considerable explanation regarding the preferred lengths and the results of using different lengths is included in the specification. The statement referred to by the Examiner obviously means that the applicants do not wish to be limited to any exact length as the invention may be practiced by selecting any one of various different lengths occurring within that range which will produce the desired results.

Div. 50 Room 322 II-D Paper No. 4

Address only
"The Commissioner of Patents,
Washington, D. C."
and not any official by name

DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE
WASHINGTON

All communications respecting this
application should give the serial number,
date of filing, and name of
the applicant.

MAILED
DEC 13 1930

Please find below a communication from the EXAMINER in charge of this application.

Thomas E. Robertson
Commissioner of Patents.

Applicant: C. A. Cherry et al

Wilkinson, Huxley, Byron
& Knight,
First National Bank Bldg.,
Chicago, Illinois.

Ser. No. 334,132
Filed Jan. 21, 1929
For Moldable Composition Of
Matter And Process For
Producing Same

In response to Communication filed Mar. 13, 1930.

Additional reference made of record:

Talley, 1,223,216, Apr. 17, 1917, Cl. 106-22C.

The claims are again rejected on the art and for reasons of record. The references cannot be dismissed from consideration on a bare allegation that they are not operative to produce the desired combination of strength and flowability, either in the original description, or in "remarks".

The references Kempton and Smith each describe a moldable composition. Each indicates that the strength of the molded article is greater than where the usual comminuted or pulped fibre is used. The flowability is dependent on a number of factors, not included in the claims, such as temperature at molding pressure, fluidity of the resinous binder, relative proportion of binder to filler, solvents, fluxes, plastifiers, etc.

The "string-like" material of the present description is apparently preferred to be in shorter lengths than that recommended by Smith, and longer than the material resulting from Kempton's process of shredding impregnated canvas.

Where, as in the present case, the difference is merely one of degree, and is intermediate the two references, and is indefinitely stated, "relatively short pieces", and the result appears to be practically the same as that described by the references, such difference is not considered of patentable merit.

Claims 1, 2, 6, 7 are considered to be squarely readable on either Kempton or Smith.

An additional refarence, Talley, is cited herewith, showing that the increase in strength due to the use of long fibres is well known.

Ch. Blake

Elw

EXAMINER.

15 R

5/A w affidav

(Case No. 28,684).

JUN 12 31

IN THE UNITED STATES PATENT OFFICE

In re application of
OSCAR A. CHERRY, et al.
MOLDABLE COMPOSITION OF MATTER AND PROCESS OF PRODUCING SAME
Serial No. 334,132
Filed January 21, 1929

Div. 50
Room 322

U. S. PATENT OFFICE
FILED
JUN 13 1931
DIVISION 50

AMENDMENT

Hon. Commissioner of Patents,
Washington, D. C.

Sir:

Responsive to the Official Action of December 13, 1930. kindly amend the above-identified application as follows:

Page 3, line 16, after the period insert --The filler material may be termed "spun fibrous material in string-like form" and it should be understood that an important aspect of the invention consists in the fact that the filler material retains its character of spun and twisted fibers in the molding composition and in the final article and therefore imparts greater strength, and can be obtained by loose fibrous filler material.--

a'

Cancel all the claims and insert the following new claims:

--8. A thermoplastic molding composition comprising a thermoplastic reactive resinous binder and a filler consisting of relatively short lengths of spun fibrous material in string-like form.

a²

9. A thermoplastic molding composition comprising a thermoplastic reactive resinous binder and a filler coated with the binder consisting of relatively short lengths of spun fibrous material in string-like form.

334132
#

10. A thermoplastic molding composition of substantially uniform quality and having a high degree of flowability

into irregular molded shapes comprising a thermoplastic reactive resinous binder and a filler coated with the binder consisting of pieces of spun fibrous material in string-like form of a length less than two inches.

11. The process of molding which consists in coating a continuous length of spun fibrous string material with a solution of a thermoplastic reactive resin, drying the coated string, cutting the coated string into relatively short lengths and molding an intermingled mass of the short lengths of string under conditions of heat and pressure in such a manner that the mass flows to an appreciable extent during molding.

2

12. The process of molding which consists in coating a continuous length of spun fibrous string material with a solution of a thermoplastic reactive resin, drying the coated string, cutting the coated string into pieces of length less than two inches and causing an intermingled mass of the coated pieces of string to flow under conditions of heat and pressure in a mold.

13. A molded article of manufacture of irregular shape and uniform quality having a high tensile strength and high resistance to fracture by impact comprising an insoluble and infusible resin and a filler of relatively short lengths of spun fibrous string-like material formed in situ.

REMARKS

Reconsideration is requested of the Examiner's rejection of the present application on the ground that the improvements described are lacking invention over the prior art or on the ground that the claims fail to define a patentable invention over the prior art.

17

The specification points out that flowability is increased with shorter lengths, but that strength is correspondingly sacrificed.

The patents to Miller and Kempton are not found to be pertinent as Miller relates to raw fibers which are recognised as old in the art and Kempton employs scraps of fabric as described, as being old in the applicants' specification.

The uses of such devices are recognized by the applicants and the disadvantages thereof have been pointed out in the specification.

The claims are all limited to pieces of string, some
75 being quite specific as to length and it is accordingly
believed that they are allowable as presented.

If it is desired, the applicants will submit samples of molded objects made in accordance with the Smith process whereby he may compare the two for his own satisfaction. The differences will be obvious upon inspection.

An early and favorable action is respectfully requested.

Respectfully submitted,

WILKINSON, HUXLEY, BYRON &
KNIGHT,
Attorneys for Applicants.

March 11, 1930. Chicago, Illinois.

JPH:LH.

(Here follow photolithographs, side folios 76-79.)

80 This invention was developed by men skilled in
the art of molding practice, especially of thermoplastic resins which react under conditions of heat and pressure to produce the final infusible and insoluble article. The inventors were well aware of prior practice in the use of fillers coated or impregnated with a reactive resin, as disclosed by commercial practice, publications or by issued patents. The Examiner has no doubt made a full and complete search but has failed to find references describing prior methods other than such as are clearly referred to in applicants' specification. It seems clear that the specification does distinguish the new method of molding, the molding composition itself and the final article from previous disclosures and only remains to determine whether the im-

provements described would have been obvious and would produce expected results to those skilled in the art from a consideration of the prior disclosures or would not be obvious and would produce unexpected results, so that applicants should be accorded the benefit of a patent for their new disclosure.

In accordance with the well established practice, if there is a reasonable doubt it should be resolved in favor of the applicant and the Examiner should not make assumptions departing from the disclosures of the prior patents. Furthermore, the Examiner should not question the statements in applicants' specification that their improvements result in unexpected properties unless it is clearly evident that such statements are incorrect. As a matter of fact the improvements described herein are becoming increasingly important through commercial practice of the invention. A sample of a molded article produced in accordance with applicants' teaching has been previously submitted to the Examiner and at this time an affidavit is presented,
81 sworn to by one of the inventors, which sets forth the new and unexpected results of the present improvements and the distinctions over the prior art. This affidavit should resolve any doubt in the Examiner's mind that the differences are merely that of degree in favor of applicants' contention that the results are unexpected.

The problem presented to applicants was to overcome the objections to current molding practice of a composition consisting of a coated or impregnated filler, especially in producing irregular shapes. Wood-flour, asbestos or substances similar in consistency have been commonly used as a filler material. An impregnated mass of such a filler will readily flow during the molding step into irregular shapes and will present a good surface appearance in the finished article. However fillers of such finely divided character do not produce sufficient strength in the finished article for resistance to fracture by blows. It was recognized that filler material having a longer fiber should result in increased strength and the Kempton patent discloses one method of improving the strength of molded articles which consists in impregnating woven fabrics in sheet form with a phenolic condensation product, drying the impregnated material and then shredding or otherwise comminuting the fabric into a "loose fluffy mass of long fibers". It was pointed out by Kempton that prior to his disclosure it had been proposed to mix long cotton fibers with a powdered binder in a dry state or to add the binder in the form of a solution to the cotton fiber and his improvement principally consisted in impregnating the fibers while in the form of fabric in order to finally obtain a loose fluffy mass instead of a lumpy mixture.

82 The shredding, chopping or grinding described by Kempton results in reducing the fabric to single fibers and the twisted or spun character of the threads composing the fabric is substantially destroyed. It is admitted by the applicants that a method such as Kempton describes, in which the filler is present in the finished article in the form of fibers longer than with previous short fiber fillers, will result in increased strength for resisting fracture by blows but the tensile strength or modulus of rupture is substantially the same as articles formed from short fiber material. According to Kempton's method there may be small pieces of fabric which have not been reduced to the natural fiber and such small scraps of cloth objectionably appear in irregular spots of contrasting color in the surface of the finished article. If small scraps of cloth are present in the filler the material cannot be uniform in appearance. It would be extremely difficult for Kempton to produce a filler of uniform quality.

Having the Kempton patent in mind it certainly would not be obvious to one skilled in the art that improved qualities would be obtained by impregnating the material in spun fibrous string-like form and reducing the continuous string to relatively short lengths prior to molding. This would be a radical departure from Kempton's disclosure since it would not require shredding or grinding and the material would not be reduced to its natural state of single fibers. To produce greater strength of articles according to the Kempton disclosure, it would seem that the obvious suggestion would be to preserve the fabric structure by merely cutting the impregnated fabric into small pieces instead of actually shredding or grinding the fabric but such material in scrap-like form would not present a uniform and pleasing appearance in the finished surface of the molded
83 article and would tend to reduce flowability of material during molding. Therefore, reasoning from Kempton's disclosure alone, applicants' improvements would not be obvious.

Coming now to the Smith patent we find an entirely different suggestion. Smith describes the placing of a ball of spun yarn in an impregnating solution under high pressure which is required unless the period of time is of no consequence, in which case impregnation may be effective at atmospheric pressure by leaving the ball of fibers in the solution for a few days. The impregnated yarn is unwound and dried. In order to use the material it is heated to become soft and pliable and then a sufficient quantity is placed in a mold in a tangled or haphazard condition. The spun character of the yarn is preserved but the flowability of the material is very slight and articles of irregular shape cannot be formed from such material. The continuous string of yarn in the mold will be held at so many points that intermediate portions will not be free to flow. It cannot be said that it would be immediately obvious to one skilled in the art that the impregnated yarn of Smith's disclosure should be cut into relatively short lengths in order to obtain the improved qualities which the applicants have discovered. The Kempton patent would not offer any suggestion as to the improvement of the Smith disclosure except that possibly the impregnated yarn might be shredded or comminuted as in Kempton and thereby be reduced to the state of loose fluffy fibers, but this would be a radical departure from the spirit of Smith's disclosure. On the other hand, the Smith patent would not offer any suggestion for the improvement of the Kempton method unless it might be said that the impregnated fabric in Kempton could be placed in a mold without shredding or cutting. Reasoning from either Smith or Kempton alone, or from
84 both together, applicants' method would not be arrived at.

The filler material as disclosed in the present specification results in finished articles having a greater tensile strength than articles produced from short fiber material, such as wood-flour, and from longer fiber material, such as Kempton describes, obtained from shredding of impregnated fabric. The resistance to fracture by blows of the finished article is also greater than could be obtained from prior disclosures. The molding composition results in a more uniform and pleasing appearance than in articles produced according to Kempton's teachings. Finally, the molding composition described herein has a much wider application in the production of molded articles than such prior practice, as described by Smith. For these reasons it is considered that applicants have disclosed a patentable invention over the prior art and any doubts as to whether such improvements would be obvious in view of patents which have been part of the art for several years prior to applicants' disclosure should be resolved in favor of the inventors. It only remains to point out to the Examiner that the claims as now presented define and limit the invention to what they have accomplished.

In regard to the matter of the flowability of applicants' molding composition the Examiner indicates that the degree of flowability is dependent upon many different factors, such as, for example, the fluidity of the resinous binder. This may be true to some extent but it is still contended that if applicants' improvements result in increased flowability of the material without modification of the other factors, a new result is obtained. If it is attempted
85 to increase the flowability of the molding composition
by rendering the resin more fluid, there will be a tendency for the resin to be squeezed out from the filler and the filler will not flow uniformly with the resinous binder resulting in articles of uneven strength. However, regardless of any modification of the factors governing flowability of the molding composition, it is impossible by practicing the disclosure of the Smith patent to preserve the strength and obtain a flowability of material for the production of irregular shapes such as can be readily obtained by practicing the improvements of the present disclosure.

In defining and limiting the present invention the terminology of "relatively short lengths" should be interpreted in the light of the disclosure in the specification wherein applicants state that lengths as short as ⅛ of an inch have been found to give improved results and that the length may be increased up to 1½″ or above. In setting a definite maximum limit the applicants have referred to two inches in original claim 4. Regardless of the length, the filling material retains its quality of a spun fibrous string-like form so that it is distinguishable from Kempton. Applicants' material is further distinguishable from Kempton since it is of a uniform quality which could not be obtained by Kempton. The difference from Smith is not merely of degree since applicants' composition retains the advantages of great strength such as present in Smith, and the character of flowability such as present in Kempton. There is no suggestion in Smith that the flowability can be increased by using shorter lengths of string and therefore the change which applicant has made is not merely one of degree but is an entirely new step.

86 The claims have been entirely rewritten and are believed to properly define the inventive subject-matter. Claims 8, 9 and 10 relate to the molding composition. Claims 8 and 9 define the filler as consisting of relatively short lengths of spun fibrous material in string-like form. This language distinguishes from "loose fluffy fibers" as in Kempton, and from macerated fabric which has been employed as a filler in a manner somewhat similar to Kempton. The language distinguishes from Smith by specifying relatively short lengths of material. Claim 10 recites a molding composition of substantially uniform quality having a high degree of flowability into irregular molded shapes thereby distinguishes from Smith. The filler material is limited in this claim to pieces of a length less than two inches.

Claims 11 and 12 relate to the process of molding which consists in cutting a continuous length of string, which has been coated with a binder, into relatively short lengths and molding an intermingled mass of the short lengths of string in such a manner that the mass flows to an appreciable extent during molding. The process is obviously not found in Kempton and contains an additional step over the process of Smith. Claim 12 is similar to claim 11 except that it is limited to cutting the string into pieces of length less than two inches.

Claim 13 relates to a molded article of irregular shape and uniform quality having a high tensile strength and high resistance to fracture by impact comprising a resin and a filler of relatively short lengths of spun fibrous string-like material.

In view of the present argument it is considered that the Examiner, upon reconsideration of the application, will find the present claims to be allowable and the application should be passed to issue.

87 Respectfully submitted,

WILKINSON, HUXLEY, BYRON
& KNIGHT,
Attorneys for Applicants.

(Chicago, Illinois, June 10, 1931.)

EHT:FW.

88 [Stamp:] Mail Division, U. S. Patent Office. Jun. 12, '31.

[Stamp:] U. S. Patent Office, Division 50. Filed Jun. 13, 1931.

In the United States Patent Office.

In re application of Oscar A. Cherry et al. Holdable Composition of Matter and Process of Producing Same. Serial No. 334,132. Filed January 21, 1929.

Affidavit.

State of Illinois,
County of Cook, ss:

Oscar A. Cherry, being duly sworn, deposes and says that he is one of the inventors in application Serial No. 334,132, filed January 21, 1929, entitled "Moldable Composition of matter and process for producing same"; that the following statements are true to the best of his knowledge and belief; that he, for a period of ten (10) years has devoted a portion of his time to the study and development of molding compositions of the type including a thermoplastic reactive resin and that he has been associated with a company which is engaged in the commercial development of such composition and manufacture of molded articles therefrom; that he, in view of his experience, is quite familiar with current practice in this art.

According to his knowledge at the time of the development of the present invention the filler material most commonly used together with a binder of thermoplastic reactive resin was wood-flour, asbestos or substances of similar character having a short fiber length; that macerated fabric was also used as a filler material and in this form the fibers retained a character of spun and twisted threads in the finished article; that he was also aware of the suggestion contained in the patent to Smith, No. 1,557,730, in which a continuous string of fibrous material, impregnated with a binder was used for the manufacture of a molded article.

89 The problem in the art was to develop a molding composition that could be used to produce molded articles, capable of being formed by flowing of the molding composition in the mold, which would have a strength both against resistance to breakage by a direct tensile stress and from resistance to fracture by impact and which would produce a finished molded article of uniform quality with a smooth and uniform surface appearance; that the invention disclosed in the above-identified application consists in the use in a molding composition of relatively short lengths of spun fibrous string-like material previously coated or impregnated with a binder of thermoplastic reactive resin;

That he has conducted tests of molded articles having different types of filler material, such as above referred to, and has found the following results:

In tensile strength, articles produced with a wood-flour filler have a strength of 6,000 to 7,000 pounds per square inch; articles produced from a macerated fabric have a strength in tension from 7,000 to 8,000 pounds per square inch; articles produced with a continuous length of string as a filler have a tensile strength of about 14,000 pounds per square inch and molded articles manufactured in accordance with the disclosure in the above-referred to application have an average tensile strength, when the short pieces of string are about 1½ inches in length, of from 14,000 to 15,000 pounds per square inch and that a maximum tensile strength of 18,000 pounds per square inch has been obtained.

The resistance to fracture by impact of such molded articles has been found to be substantially, as follows:

Articles with a wood-flour filler 2 inch pounds; articles having a macerated filler of about 10 to 15 inch 90 pounds; articles having continuous length of string about 50 to 75 inch pounds; articles having relatively short pieces of string about 50 to 75 inch pounds.

Div. 50 Room 4701 280 Paper No. 6

Address only
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and not any official by name

IX/R DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE
WASHINGTON

All communications respecting this application should give the serial number, date of filing, and name of the applicant

JAN 15 1932

Please find below a communication from the EXAMINER in charge of this application.

Thomas E. Robertson
Commissioner of Patents.

11—8633

Applicant: Oscar A. Cherry et a

Wilkinson, Huxley, Byron & Knight,
1st Nat. Bank Bldg.,
Chicago, Illinois.

Ser. No. 334,132
Filed Jan. 21, 1929
For Moldable Composition of Matter etc.,

In response to communication filed June 12, 1931:-

The claims are again and finally rejected on the art and for reasons of record.

The affidavit and remarks of counsel have been studied. Talley has been ignored. The affidavit merely gives information that would be obvious from a consideration of Talley, i. e. that long and strong fibrous materials give greater strength than does short and weak fiber. The use of "relatively short lengths of spun fibrous material of stringlike form", as called for by the present claims, is considered to be but a difference of degree from and intermediate between Smith and Kempton of record, and is also considered to be the equivalent of Talley's hemp and similar long fibres (page 1, lines 63 to 67).

EvG

C. L. Blake

Examiner.

30 R

The tests which have been conducted indicate that the tensile strength of articles having a filler in a string-like form is materially greater than articles having a wood-flour filler or a macerated fabric filler and it was not expected that an increased tensile strength would be obtained over articles having a macerated fabric filler. The tests also indicate that the resistance to fracture by impact is materially greater with filler in a string-like form than could be obtained from wood-flour filler or macerated fabric filler; that, in his opinion, the increased strength is due to the fact that the filler material retains the character of spun and twisted fibers and is capable of intermingling and interlocking to a greater extent than can be obtained with macerated fabric;

That he has found from conducting tests of a molding composition consisting of a continuous length of impregnated string-like material that articles cannot be satisfactorily molded therefrom if it is necessary for the molding composition to flow to an appreciable extent, whereas, by following the teachings of the above-referred to application, the molding composition is found to freely flow to all parts of the mold and therefore it is possible to produce articles of irregular shapes. Articles molded in accordance with the teachings of the said application are found to have a uniform strength and quality and the improved molding composition has therefore solved a need which was present in this art.

Further the deponent sayeth not.

OSCAR A. CHERRY.

91 Subscribed and sworn to before me this 9th day of June, 1931.

[SEAL.] FRANCES L. WEIBEL,
Notary Public.

(Here follows photolithograph, side folio 92.)

93 [Stamp:] Mail Room, U. S. Patent Office. Feb. 8, 1932.

[Stamp:] Board of Appeals, U. S. Patent Office. Feb. 10, 1932.

Appeal #7

(Case No. 28,684.)

In The United States Patent Office.

Division 50, Room 4701.

In re Application of Oscar A. Cherry, et al. Moldable Composition of Matter and Process of Producing Same. Serial No. 334,132. Filed January 21, 1929.

Appeal.

Hon. Commissioner of Patents,
Washington, D. C.

SIR:

Appeal is hereby made to the Board of Appeals from the decision of the Principal Examiner in the matter of the above entitled application, of which, claims 8 to 13 inclusive, were finally rejected on the 15th day of January, 1932.

The following are the points of the decision on which the appeal is taken;

1. The Principal Examiner erred in rejecting claims 8 to 13 inclusive on the patent*ed* cited for the reasons of record.

2. The Principal Examiner erred in refusing to allow the claims designated in the foregoing paragraph.

3. The Principal Examiner erred in his ruling that the claims above referred to cover only an obvious development over the disclosures of the prior art references cited.

4. The Principal Examiner erred in holding that the invention set forth in the claims above referred to involved only a difference of degree from an intermediate between the patents to Smith and Kempton of record.

94 The Principal Examiner erred in his holding that the invention set forth in the claims above referred to was the equivalent to the disclosure of Talley which employs hemp and similar long Fib*u*res.

6. The Principal Examiner erred in his failure to further recognize and give weight to the Affidavit of the applicant filed with the amendment of June 12th, 1931 and the flowability and molding quality of the material of this invention as verified in said Affidavit.

An oral hearing is requested.

A check in the amount of $15.00 is enclosed herewith to cover the cost of filing the Appeal.

WILKINSON, HUXLEY, BYRON
& KNIGHT,
Attorneys for Applicant.

February 6, 1932. Chicago, Illinois.

JPH:LH.

95 [Stamp:] Mailed Mar. 11, 1932.

Department of Commerce, United States Patent Office

Before the Board of Appeals on Appeal.

In re Application of Oscar A. Cherry et al. Serial No. 334,132. Filed Jan. 21, 1929. For Moldable Composition of Matter and Process for Producing Same

Examiner's Statement.

This is an appeal from the final rejection of Claims 8 to 13, appearing in Paper #5, to which attention is respectfully directed.

The references relied on are:

Miller, 1,061,770, May 13, 1913,
Talley, 1,223,216, Apr. 17, 1917,
Kempton, 1,513,323, Oct. 28, 1924,
Smith, 1,557,730, Oct. 20, 1925.

The claims relate to a moldable composition using a thermoplastic heat hardenable artificial resin as the binder. With such resins there is ordinarily used an approximately equal quantity of filler. The filler may be a powdered mineral substance such as clay, slate talc etc. or it may be a fibrous filler, the usual examples of which are cotton flock, wood meal or asbestos fibre. The particular distinction here is said to reside in the use of "relatively short lengths of spun fibrous material in stringlike form". The description refers to the use of yarn such as four ply cotton yarn. The pieces may be as short as an eighth of an inch, or as long as one half inch. It is said that pieces over an inch and a half may be used, but that the plasticity decreases rapidly for increases in length above the last mentioned value. The advantage in the use of pieces of yarn in place of ordinary fibre is said to be in a greatly increased strength of the resultant molded article, particularly the impact strength. It is said that all materials of a 96 "stringlike nature" give the advantage. It is indicated that pieces of a half inch length yield stronger articles than those of an eighth inch in length. The resin is incorporated with this filler by impregnating or coating the twine with the resin and then cutting the twine into short lengths.

The desirability of strong, long fibrous elements in molded products is well recognized.

Miller produces a gear wheel by compressing textile fibres between two plates. Apparently, no binder is used.

Kempton was working on the same problem as the present applicants are concerned with. He impregnated canvas with a resin and then shredded the canvas to provide long cotton fibres which he states gave a much stronger product when molded than was obtainable by the use of conventional fillers.

Talley was also concerned with the same problem. He uses fibrous materials having long fibres. This material is impregnated with a resin and after drying molded.

Smith is likewise concerned with the same problem. Yarn in balls or on spools is impregnated with a resin and then dried. The yarn is placed in the mold in a tangled mass and molded in the usual manner with heat and pressure.

It will be evident that the sole issue of the case is the question of the merit of the use of "relatively short lengths of spun fibrous material in stringlike form". The expression is indefinite as to the length. It seems to be intended to include pieces as short as an eighth of an inch and also lengths greater than one and one-half inches. No great difference is seen between yarn cut in lengths of an eighth inch and Kempton's shreded fabric, particularly if it be duck (page 2, line 5). Talley states that the *mass* is loose and fluffy while applicants state that their individual pieces are "string-like". That is a matter depending on the 97 character of the yarn and on the degree of impregnation, and of course on the point of view.

On the other hand it is considered that pieces greater than an inch and a half in length would form a tangled mass in a mold which would be exactly the equivalent of Smith's tangled mass. There is nothing in Smith to indicate that he is to be confined to the use of one continuous piece for each filling of the mold. No essential difference is seen between a sufficient number of pieces over one and one-half inches in length to fill a small mold, and one or two pieces in a tangled mass for the same purpose. It thus appears that the shortest pieces here specified are fairly equivalent of Kempton and the longest are fairly equivalent of Smith. It further appears that the expression used to define the lengths is indefinite. Claim 10 does define the maximum length as two inches. There is nothing in the case to indicate that this length is critical. The last few lines of page 5 would indicate that such length would not be as plastic as desired.

An affidavit was filed by one of the applicants. It states that wood flour molded articles using wood flour as a filler are the weakest with macerated fabric, (character not stated) are next, and the continuous string filler next. The last mentioned and pieces of one and a half inches yield articles of about the same strength. The claims are not limited to one and one-half inch lengths of string. Nothing in the affidavit shows any real difference over Smith, nor is there any indication that pieces of string as short as one-eighth inch are different from Kempton's shredded canvas.

C. L. BLAKE,
Examiner, Division 50.

98 Address only The Commissioner of Patents, Washington, D. C.

Appeal No. 4851. Paper No. 9.

Department of Commerce, United States Patent Office,
Washington.

April 11, 1932.

SIR:

The case of Oscar A. Cherry et al., Serial No. 334,132, will be heard by the Board on the 22nd day of July, 1932.

The hearings will commence at 1:30 P. M. and as soon as the argument in one case is concluded the succeeding case will be taken up.

If any party, or his attorney, shall not appear when the case is called, his right to an oral hearing will be regarded as waived.

The time allowed for arguments is as follows:

Ex parte cases, thirty minutes;

Inter partes appeals: Interlocutory and final hearings when no testimony has been taken, thirty minutes each side; final hearing when testimony has been taken, one hour each side.

By special leave, obtained before the argument is commenced, the time may be extended.

The appellant shall have the right to open and conclude in inter partes cases, and in such cases a full and fair opening must be made.

Briefs in inter partes appeals must be filed in accordance with the provisions of Rules 144 and 163.

Respectfully,

THOMAS E. ROBERTSON,
Commissioner of Patents.

To Messrs. Wilkinson, Huxley, Bryon & Knight, First National Bank Bldg., Chicago, Ill.

99 Address only the Commissioner of Patents, Washington, D. C.

Paper No. 10.

Department of Commerce, United States Patent Office,
Washington.

July 18, 1932.

SIR:

The case of Oscar A. Cherry and Franz Kurath, Serial No. 334,132, will be heard by the Board of Appeals on the 14th day of September, 1932.

The hearings will commence at 9.30 A. M. and as soon as the argument in one case is concluded the succeeding case will be taken up.

If any party, or his attorney, shall not appear when the case is called, his right to an oral hearing will be regarded as waived.

The time allowed for arguments is as follows:

Ex parte cases, thirty minutes;

Inter partes appeals: Interlocutory and final hearings when no testimony has been taken, thirty minutes each side; final hearing when testimony has been taken, one hour each side.

By special leave, obtained before the argument is commenced, the time may be extended.

The appellant shall have the right to open and conclude in inter partes cases, and in such cases a full and fair opening must be made.

Briefs in inter partes appeals must be filed in accordance with the provisions of Rules 144 and 163.

Respectfully,

THOMAS E. ROBERTSON,
Commissioner of Patents.

To Messrs. Wilkinson, Huxley, Byron & Knight, Attys., First National Bank Building, Chicago, Illinois.

100 [Stamp:] Board of Appeals, U. S. Patent Office. Jul. 18, 1932.

In the United States Patent Office.

Div. 50, Room 4701.

In re Application of Oscar A. Cherry et al. Moldable Composition of Matter and Process of Producing Same. Serial No. 334,132. Filed January 21, 1929.

Letter.

Hon. Commissioner of Patents,
Washington, D. C.

Sir:

The above identified application is now pending before the Board of Appeals, awaiting an oral hearing which has been set for the 22nd day of July, 1932, at 1:30 P. M.

Since taking the appeal, the merits of the invention here under consideration were discussed with the Examiner, who passed upon the patentability of this case and it was there pointed out that additional fact information concerning the invention would be extremely advantageous to a full and accurate understanding thereof.

Accordingly, under the authority of Rule 138 of the Rules of Practice, tests have been conducted for the purpose of developing fact information which support the applicants' contentions of patentability. The Affidavit is attached hereto and it is respectfully requested that the affidavit be entered and considered in connection with further consideration of the merits of this case.

It is respectfully urged that the information here given is highly important to a proper understanding of this invention and that the Board of Appeals, in the exercise of their discretion under Rule 138, order that the Affidavit be received and considered.

101 If the consideration of this affidavit necessitates a re-setting of the Appeal and it is requested that the date now set, namely, the 22nd day of July, 1932, at 1:30 P. M. be changed to a later date, after which the Examiner had had an opportunity to consider the affidavit and make appropriate recommendations in view thereof, to the Board of Appeals.

Respectfully submitted,
WILKINSON, HUXLEY, BYRON & KNIGHT,
Attorneys for Applicants.

Chicago, Ill., July 16, 1932.

JPH:LH.

IN THE UNITED STATES PATENT OFFICE

IN RE APPLICATION OF
OSCAR A. CHERRY, ET AL
MOLDABLE COMPOSITION OF MATTER
& PROCESS OF PRODUCING SAME
SERIAL NO. 334,132
Filed Jan. 21, 1929

BOARD OF APPEALS
JUL 18 1932
U.S. PATENT OFFICE

AFFIDAVIT

STATE OF ILLINOIS
COUNTY OF COOK } SS

HARRY DELPRAT DARLINGTON, being duly sworn, deposes and says that he is a citizen of the United States and a resident of Chicago, County of Cook, State of Illinois; that he is employed as a chemist for the Economy Fuse & Manufacturing Company, the Assignor of the above identified application; that he is familiar with the disclosure of said application and knows and understands the invention described therein and that acting in the regular course of business, he has conducted certain experiments based upon the discovery of said invention which he here sets forth for the purpose of distinguishing the characteristics of the invention from the prior art practices as set forth in the patents of record and as explained in the article of W. H. Kempton appearing on pages 62, 63, 83 and 84 of Volume 8, #2, of the publication entitled "Plastics and Molded Products" published February, 1932; that the following experiments were conducted by him and that all tests and measurements were made and recorded by him; that the following statements are true and are given as the result of the experiments conducted.

In many cases of common knowledge the strength of a material depends to a considerable extent upon the length of the fibres of which it is composed. Twine is a very good example -

and two cases are immediately apparent. Cotton fibres of 1-1/16 inch length make up into a twine of greater tensile strength than fibres of 1 inch length. The processing known as combing is essentially one of removing short fibres, and as a result a combed yarn has a higher tensile strength than ordinary or carded yarn.

A black 8s/4 ply twine was coated with a phenolic resin to form a molding composition of about 45% binder and samples were prepared from different lengths of coated twine with the following results:

Length	Tensile	Transverse	Shear (a)	Shear (b)	Modulus of Elasticity	Impact
Uncut	8,015	34,625	15,530	12,000	2,890,000	34.0
3	6,940	34,050	15,530	11,670	2,950,000	36.0
2	8,020	28,775	14,800	11,000	2,530,000	38.0
1	12,700	23,850	12,650	11,900	1,925,000	38.5
1/2	12,150	14,775	11,883	11,070	1,850,000	31.0
3/16	7,240	14,550	11,850	13,200	1,730,000	20.0

The tensile strengths do not indicate that the excessive lengths play any part in the role of strength. The fact that a maximum is reached between 1/2 inch and 2 inch length indicates that, like the twist of a yarn, length is helpful up to a certain point and then does more harm than good.

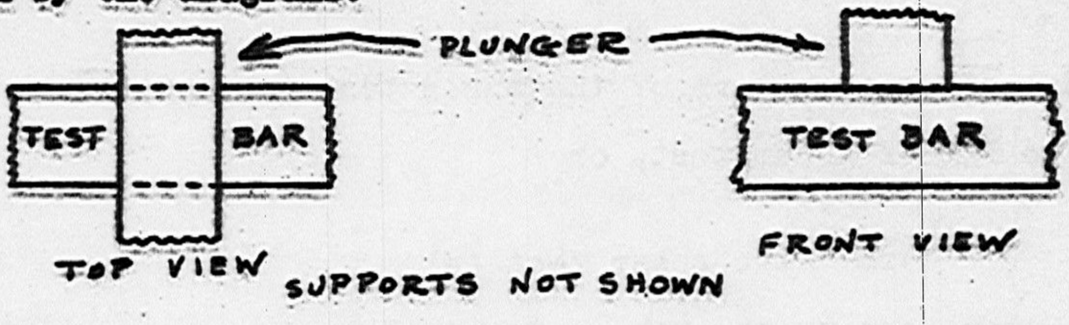
The test for impact resistance does not exactly parallel the results on tensile strength, but a similarity can be noted in the reaching of a maximum between the 1/2 and the 2 inch lengths.

The transverse strength, shear test (a), and the modulus of elasticity show a definite relationship with the longer lengths having the advantage. This is apparently due to the narrowness of the die causing all pieces in general, to lie flat and parallel. The advantage of length is apparently lost when the length of twine becomes equal to or less than the width of the die

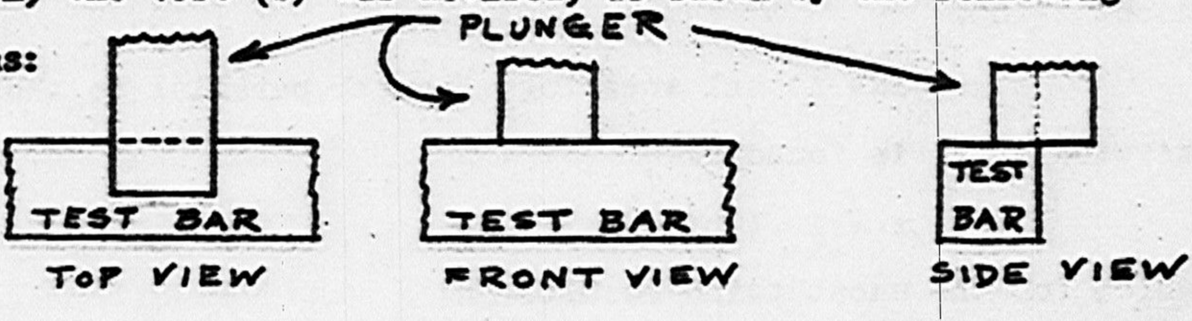
41

(1/2 inch). This is particularly evident in the transverse strength and in shear test (a).

Shear test (a) was made across the lengths of twine as shown by the diagrams.



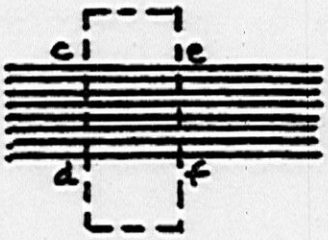
In order to determine the uniformity of shearing strength, the test (b) was devised, as shown by the following diagrams:



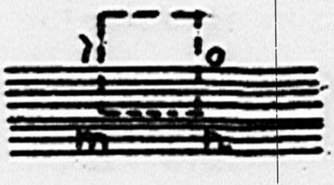
In other words, test (a) was a measure of shearing strengths across all fibres if they were laid parallel, and as the lengths became smaller, approached the value of the shearing strength of a bar in which the fibres had a maximum distribution as regards direction of repose.

Shearing test (b) was a measure of one half of (a), that is the shear across all fibres in the hypothetical case, plus the shear of an equal area parallel to the fibres. This perhaps can be illustrated to advantage by the following:

(a)



(b)



To further illustrate this theory it can be assumed that the bars are of equal dimensions and that the plunger widths are equal to the width of the bar. The test (b) is acting on one half of the bar only; but it is apparent that the section areas in shear are equal. It therefore follows that:

$$\overline{cd} + \overline{ef} = \overline{lm} + \overline{mn} + \overline{no}$$

but $\overline{cd} + \overline{ef}$ is a measure of the shear test (a) and $(\overline{lm} + \overline{no})$ is equal to 1/2 of shear test, or

$$\overline{mn} \overset{?}{=} 1/2 \text{ shear test (a)}$$

if the shear across the fibres is equal to the shear parallel to the fibres, which is untrue by inspection of the results for the uncut twine.

The actual shearing strength parallel to the fibres, assumed as x, is found by

$$x = 2 \quad (b - \frac{a}{2})$$

which for the uncut twine results in

$$x = 2 \quad (1200 - \frac{15530}{2}) \quad = \quad 8,470$$

Maximum distribution of the fibres should by means of summation yield a result which amounts to an average of the maximum shear across the fibres and the maximum shear parallel to the fibres. This average is, for uncut twine, only, 12,000 lbs. per square inch - the maximum distribution is obtained with the 1/2 and 3/16 inch lengths and the average shear for these lengths including both (a) and (b) tests is 12,000 per square inch. This check figure is not to be expected on all tests, but it is believed to be indicative of the proof of the theory that any variation of shearing strength is due to the position of the fibres and not to their length.

This same theory is applicable to the transverse strength and the modulus of elasticity.

Applying this theory to the tensile strength, it is apparently possible to obtain a high strength when the fibres are laid parallel to each other and to the direction of the breaking strain. Under normal loading conditions, the maximum distribution would be obtained with short lengths, and with longer lengths a higher strength could be expected, which is found to be true. When exceptionally long lengths are used, however, the tensile strength is found to be lower. This is no doubt due to the coiling of the twine during loading which results in some sections not having the fibres parallel to the applied testing stress but at right angles to it.

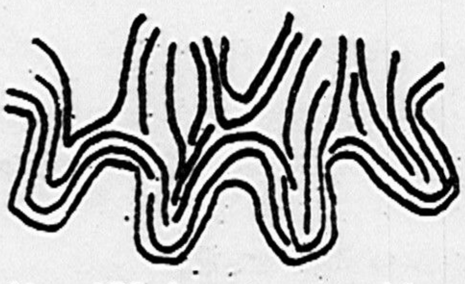
This theory is further proven by the following tests on a composition prepared with the same binder and binder content but with cotton batting as a filler:

Tensile	-	9,750
Transverse	-	15,550
Shear (a)	-	12,070
Shear (b)	-	12,800
Modulus of elasticity	-	1,900,000
Impact	-	16.5

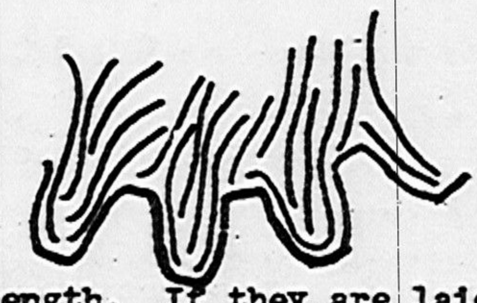
These values are very close to those of the short length twine materials, and represent probably the closest thing to the theoretical maximum distribution of the cotton fibres.

If the actual molding procedure be considered, it will be seen that a variation in length of material can be made to increase the strength - but some other point or part of the molded piece will be weakened. If in a gear molded directly from twine of suitable length placed so that in molding the twine will assume in general the positions shown

X



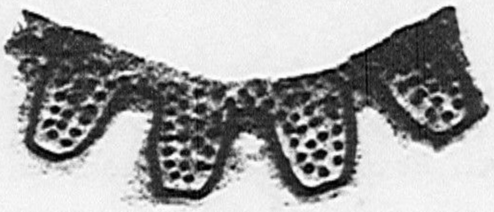
or Y



the teeth will have exceptional strength. If they are laid so that they are parallel to the teeth, as shown below:

44

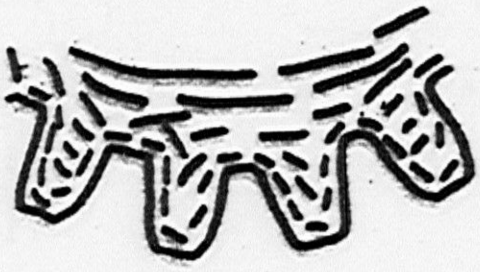
E



a weak tooth can be expected.

A gear molded from uncut or excessively long lengths is not practical as the twine will not flow into the teeth grooves of the mold. If, under excessive pressures, higher than those applied in normal molding procedure, the teeth were filled out by a force rather than a plastic flow, the twine would be broken so that the resultant composition would be short lengths placed as shown below.

W



Placing this drawing in words, the body will be strong, but the teeth will be weak due to the fact that the normal force applied will be exerted on a section area not at right angles to the fibre, but parallel to it as in the case of the line $\overline{mn}$ in shear test (b).

If a gear blank were prepared of uncut or excessive lengths of twine, and the teeth cut as in normal practice with laminated material, the drawing W would again illustrate the positions of the fibres. Every tooth would contain short lengths not in a position to offer maximum strength.

CONCLUSION

1. It is not practical to mold gears from excessive lengths of twine.

2. It is not practical to mold gear blanks from excessive lengths of twine and then cut gear teeth therein.

3. The lengths of twine to be used for molding gears must be such as to allow flow of the material into the teeth without rupture of the twine.

4. The twine must be laid, to obtain maximum strength, so that the stresses, with the exception of tensile stress are applied across the fibres.

5. The principles laid down here apply to all products which may be molded, except that uncut twine can be used only for the very simplest of shapes.

SUBSCRIBED AND SWORN TO before me this 16th day of July, 1932.

Lucille Hanson
Notary Public

46

U. S. PATENT OFFICE
BOARD OF APPEALS
JUL 20 1932
MAILED

Appeal No. 4851 MCV

IN THE UNITED STATES PATENT OFFICE

BEFORE THE BOARD OF APPEALS

Ex parte Oscar A. Cherry and Frank Kurath

Application for Patent filed Jan. 21, 1929, Serial No. 334,132.

Messrs. Wilkinson, Huxley, Byron & Knight for applicant.

An affidavit having been filed in this case since the appeal was taken, the application is hereby remanded to the primary examiner, under the provisions of Rule 138, for reconsideration under the provisions of Rule 76 and for report to the Board of Appeals as to his conclusions thereon.

Assistant Commissioner)

Frank C. Skinner
Examiner-in-Chief) Board of Appeals

W. S. Ruckman
Examiner-in-Chief)

July 20, 1932

110 [Stamp:] Mailed Jul. 28, 1932.

Department of Commerce, United States Patent Office.

Before the Board of Appeals on Appeal.

In re Application of Oscar A. Cherry et al. Serial No. 334,-132. Filed Jan. 21, 1929. For Moldable Composition of Matter and Process for Producing Same.

Examiner's Supplemental Statement.

The case has been remanded to the Examiner under the provisions of Rule 138, for consideration and report on the affidavit filed.

The issue of the case is as to the patentable merit of the use of "relatively short lengths of spun fibrous material in stringlike form" as a reinforcing filler for a plastic composition in place of Talley's long fibers, Kempton's shredded canvas or Smith's long pieces of string. The Examiner held that the characterization of the length in the claims was indefinite and differed in degree only from and was intermediate between those of the references, and further that the shortest lengths suggested by the description were not different from Kempton and that the longest did not give different results from Smith.

The facts given in the affidavit support the Examiner's conclusion. The tests presuppose an arrangement of the fibrous elements in the test bar so as to allign them, though no data is given as to the size of the bar or the method of distributing the fibres. There is nothing in the case or in the claims as to any method of distributing the fibres in the mold. As will be evident from a consideration of the mechanics involved, the average shearing strength should be about the same for long and short fibres, with accidental distribution, until very short fibres are used. If the fibres are alligned the advantage is with fibres sufficiently long so that the ends will be firmly held in the matrix of binder. This is evidenced by the shear tests (a) and (b), the second shear test cutting in two directions. The modulus of elasticity is of course greater with longer lengths also, up to dimensions near the length of the tested portion.

111 As was said above, the affidavit does not give any data as to the allignment of the string, nor are the claims limited in this respect. The tensile and transverse strengths apparently indicate that with the longer lengths

the fibrous elements were alligned a great deal more in a crosswise direction than in a lengthwise direction, so that the tensile test pulled the fibres apart, whereas the transverse (presumably tensile) test showed the advantage of length. Of course such tests could not be duplicated unless the method of inserting the fibrous mass in the mold was specified.

The illustrations and argument concerning the gear teeth have no pertinency to the claims in controversy.

The conclusions 1 to 4 have no relation to the claims in question but relate to the practicability (not operativeness) of a process of molding gears from the materials of the Smith patent as compared to the present material. It is to be noted that the article claims here would be squarely readable on the result of molding a gear blank and then cutting the teeth from Smith's material (see conclusion 2).

The Examiner is therefore of the opinion that the pertinent portion of the affidavit merely supports the rejection on the ground that the claims differ from the prior art in a matter of degree only and that this difference is indefinitely stated in Claims 8 to 11 and 13 and too broadly stated in Claim 12 to support applicants' contentions.

Respectfully submitted,

C. L. BLAKE,
Examiner, Division 50.

IX/K.

112 [Stamp:] Board of Appeals, U. S. Patent Office. Sep. 3, 1932.

Shepard & Shepard,
Counsel in Patent Causes,
912 Colorado Building, 1341 G Street, N. W.,
Washington, D. C.

September 2, 1932.

Hon. Commissioner of Patents,
Washington, D. C.

Cherry & Kurath. Serial No. 334,132. Postponement of Hearing Before the Board of Appeals.

SIR:

It is respectfully requested that the hearing now set for September 14, 1932 at 9:30 A. M. be postponed until September 22nd.

The above request is made in view of the fact that other engagements outside of Washington make it practically impossible that the Attorney, Mr. J. P. Hume, of Chicago, having this matter in charge, be in Washington, September 14. However, other matters require the presence of Mr. Hume in the East and in Washington on September 22nd.

Respectfully,

SHEPARD & SHEPARD,
By E. W. SHEPARD.

113 Address only The Commissioner of Patents, Washington, D. C.

Paper No. 15.

Department of Commerce, United States Patent Office, Washington.

Sept. 6, 1932.

Sir:

The case of Oscar A. Cherry and Franz Kurath, Serial No. 334,132, will be heard by the Board of Appeals on the 22nd day of September, 1932.

The hearings will commence at 9.30 A. M. and as soon as the argument in one case is concluded the succeeding case will be taken up.

If any party, or his attorney, shall not appear when the case is called, his right to an oral hearing will be regarded as waived.

The time allowed for arguments is as follows:

Ex parte cases, thirty minutes;

Inter partes appeals: Interlocutory and final hearings when no testimony has been taken, thirty minutes each side; final hearing when testimony has been taken, one hour each side.

By special leave, obtained before the argument is commenced, the time may be extended.

The appellant shall have the right to open and conclude in inter partes cases, and in such cases a full and fair opening must be made.

Briefs in inter partes appeals must be filed in accordance with the provisions of Rules 144 and 163.

Respectfully,

THOMAS E. ROBERTSON,
Commissioner of Patents.

To Messrs. Wilkinson, Huxley, Byron & Knight, Attys., First National Bank Building, Chicago, Illinois.

114 [Stamp:] Board of Appeals, U. S. Patent Office. Sep. 22, 1932.

Appeal No. 4851. Paper No. 16.

In the United States Patent Office.

Before the Board of Appeals.

In re Application of Oscar A. Cherry and Franz Kurath. Moldable Composition of Matter and Process of Producing Same. Serial No. 334,132. Filed January 21, 1929.

Brief.

This is an appeal taken from the action of January 15th, 1932 of the Examiner of Division 50, by which the six claims of this application bearing numbers eight to thirteen, inclusive, were finally rejected.

Nature of the Invention.

The invention here disclosed relates to a thermoplastic molding composition of the type comprising a resinous binder and a filling material consisting of relatively short lengths of spun fibrous material in string-like form.

The novelty of this invention resides in the filling material and the invention embraces various suitable binders such as for instance, hot molding phenol formaldehyde resins.

Claims on Which Appeal is Taken.

8. A thermoplastic molding composition comprising a thermoplastic reactive resinous binder and a filler 115 consisting of relatively short lengths of spun fibrous material in string-like form.

9. A thermoplastic molding composition comprising a thermoplastic reactive resinous binder and a filler coated with the binder consisting of relatively short lengths of spun fibrous material in string-like form.

10. A thermoplastic molding composition of substantially uniform quality and having a high degree of flowability into irregular molded shapes comprising a thermoplastic reactive resinous binder and a filler coated with the binder consisting of pieces of spun fibrous material in string-like form of a length less than two inches.

11. The process of molding which consists in coating a continuous length of spun fibrous string material with a solution of a thermoplastic reactive resin, drying the coated string, cutting the coated string into relatively short lengths and molding an intermingled mass of the short lengths of string under conditions of heat and pressure in such a manner that the mass flows to an appreciable extent during molding.

12. The process of molding which consists in coating a continuous length of spun fibrous string material with a solution of a thermoplastic reactive resin, drying the coated string, cutting the coated string into pieces of length less than two inches and causing an intermingled mass of the coated pieces of string to flow under conditions of heat and pressure in a mold.

13. A molded article of manufacture of irregular shape and uniform quality having a high tensile strength and high resistance to fracture by impact comprising an insoluble and infusible resin and a filler of relatively short lengths of spun fibrous string-like material formed in situ.

116 Character and Significance of Invention.

As previously stated, the novelty of this invention resides in the filler, which it will be noted is referred to in the claims as "relatively short lengths of spun fibrous material in string-like form". For a better understanding of the full significance of this invention, a statement of the prior practices and the problems confronting the art is deemed advisable.

Since the advent of resinous binders, particularly of the hot molding type, various practices have been developed for the production of numerous articles of commerce employing fillers of certain types held together by suitable binders. Articles of widely different characteristics have been made both as to shape and physical and electrical properties. Among the fillers most commonly used are materials such as wood flour, cotton flock, asbestos, and other organic and mineral materials which are finely subdivided to provide relatively small particle sizes. Materials of this character have served well in a large number of uses and whereas articles produced therefrom have only limited strength, these filling materials have been very desirable in that plastic masses made therefrom are quite flowable and are therefore moldable to various odd and irregular shapes. It is important however, to note at this point that prior to this invention, satisfactory moldability has been limited to those filling materials which were finely comminuted and subdivided to powdered, granular, fibrous or other similar forms.

In this group, various fibers have been employed with varying results depending upon the nature of the fiber. It may be pointed out at this point that it was known before this invention, that all other things being equal,
117 longer fibers would usually make for increased strength. However, it was also known that the moldability was impaired with the use of longer lengths of fibers and that for good moldability, it was almost considered essential to confine the filling material to the general class of more or less finely comminuted, powdered, or flocculent fillers.

As above mentioned, articles of this type, were limited in strength and therefore where excessive strengths were required, such as for instance, in gears for machine parts, or in various casings, housings and the like which suffer the abuse of impact blows, other methods have been employed in the shaping of the articles or in many cases where the shape desired was very irregular, difficult problems were presented as to the manufacture of such articles.

In this class of articles requiring higher strength it has been the practice to employ pressed laminations of fabric, paper or like fillers. For instance, it has been the practice in making gears, to impregnate sheets of canvas, fabric or the like, with the binding resin and to super-impose the sheets to form a blank which was then pressed in a hot mold. This operation results in the production of a board-like blank from which the finished gears are cut by machining operations. In many cases, suitable board-like blanks have been made with cotton fabrics or other similar laminated fillers but in all cases, a board-like blank is formed which constitutes the material from which the article is subsequently made or cut by machining or otherwise mechanical shaping and/or fitting the parts. Articles of this character have exceptional strength, particularly impact strength, as compared to molded articles using the comminuted, subdivided fillers referred to.

118 It is also old in connection with the pressed and machined type of production to utilize a ball of a continuous length of yarn which has been impregnated with

the resinous binder and to place the continuous length or ball of yarn as an entangled mass in a suitable pressing mold for forming a blank of material from which articles may be made or articles themselves of simple, regular shape.

It should be noted however, that pressed materials of the "laminated" or "ball of yarn" type are not moldable in the sense that the material will flow under the pressure of the molding operation. They are merely compressed under the hardening pressure. In such operations, moldability is sacrificed for strength. Prior to the present invention, strengths comparable to the strengths of laminated products have not been obtainable in molding compositions which could be molded to final shape, requiring a substantial degree of flowability in the mold.

The applicants have discovered that a filling material composed of relatively short lengths of spun fibrous material in string-like form provides a molding composition when mixed with a suitable resinous binder which peculiarly enough, provides the extreme strength, particularly in resistance to impact blows, comparable to pressed, laminated products or the pressed ball of string product and yet is sufficiently flowable in the mold as to be classified as a moldable thermoplastic composition.

The specification points out the range of lengths for the spun fibrous string-like material contemplated for this invention and specifically states that lengths from one-eighth of an inch up to one and one-half inches will give results falling within the range of increased strength plus satisfactory flowability. The specification also states that
119 experiments show that lengths slightly in excess of
one and one-half inches will serve satisfactorily in many uses but with some sacrifice in flowability and the length of two inches was specified as an upper limit of length in original claim four of the specification.

References Relied On.

The references relied on by the Examiner are the following prior art patents:

Kempton, 1,513,323, October 28, 1924,
Smith, 1,557,730, October 20, 1925,
Miller, 1,061,770, May 13, 1913,
Talley, 1,223,216, April 17, 1917.

Kempton Patent No. 1,513,323.

The disclosure of this patent relates to the production of a moldable composition comprising a suitable natural or synthetic binder and a filling material. Kempton refers to the disadvantage of the usual granulated or powdered fillers and to the short fibrous fillers and mentions that they have insufficient strength for various purposes and also refers to the disadvantage of laminated products and states that they can only be pressed and not molded to shape and in addition, sometimes have insufficient strength in certain directions across the article formed. He then refers to the prior use of longer fibrous material, but mentions that disadvantages have been encountered in incorporating the longer fibers with a suitable binder. The objection he states, has been that uniformity and homogeneity cannot be obtained when the fibers are mixed with the dry resinous powder and when impregnated with a solution of the binder, the mass is formed, when mixed, into a non-uniform wad or cake of fibers necessitating subsequent grinding or subdivision which destroys and damages the fibers. He therefore proposes to impregnate sheets of material, such as cotton, canvas or the like and after drying the impregnated sheet, to shred or grind it to reduce it to a *fibrous* state. Commencing in line 105, on page 1, of his specification, Kempton states:

> "The impregnated sheet material may then be shredded, chopped up, ground, or otherwise comminuted to provide a loose, fluffy mass of long fibers which are substantially uniformly impregnated with the binder employed."

It will therefore be seen that Kempton uses a mass of individual fibers instead of relatively short lengths of spun fibrous material of string-like form. Furthermore, it will be noted that Kempton's teachings are directed to the problem of providing a homogeneous mass of fibers uniformly mixed and impregnated and that his discovery runs to a solution of the impregnation and unifying problem. *He uses the raw individual fibers and not spun fibers in string-like form.*

Smith Patent No. 1,557,730.

This patent refers to the impregnation of a spun fibrous filler such as jute, cotton or the like, to form a yarn under

which term he includes string, thread, cord, twine, etc. The disclosure however, relates to *one continuous piece of yarn* and the major portion of the description is directed to the impregnation and drying steps. The impregnation
121 is effected by submerging a ball of such yarn in a solution of the resinous binder and subjecting it to high pressure, or if desired, permitting it to remain in solution for a period of several days at atmospheric pressure. The drying is accomplished by means of an electrical apparatus disclosed in his specification. The final operation is effected by means of placing the mass of a continuous length of yarn so treated into the mold and then pressing under heat and pressure to form a final product. It is to be noted that the filling material here is one continuous piece of yarn which is pressed in the mold as follows:

Referring to line 92, on page 2, of Smith's specification:

"The impregnated yarn is packed indiscriminately, that is, in a tangled or haphazard condition, into the mold so that one portion of yarn may be and is interlocked with another portion, the fibers thereof being thus interlocked and bound together."

The composition formed by Smith is substantially nonflowable and the objects formed must be simple and regular in shape as he is restricted in his operation to a mere pressing action. The formation of objects of irregular shape can only be made by subsequent machining or other mechanical operations.

Miller Patent No. 1,061,770.

The patent to Miller has little or no bearing on this invention as it does not relate to the production of a moldable composition but merely to a gear wheel composed of circular disks of textile fibers cut from a batting or layer of such fibers and stacked one on top of the other and held under compression between two metallic plates. The
122 teeth on the fiber portion of the gear are cut therefrom by mechining operations in the manner similar to the production of ordinary gears. This is clear from the following statement which is taken from lines 81 to 87 inclusive, of page 1, of his specification:

"After the textile body of the gear has been compressed to the proper degree between the metallic end plates and the compression-sustaining means secured, the gear blank thus formed may be removed from the press and turned and milled according to the practice in making metallic gears."

The textile body referred to has no binder with it and therefore it is not a moldable composition in any sense.

Talley Patent No. 1,223,216.

This patent relates to a molded gear formed from fibrous material of lengths somewhat greater than the usual granulated, powdered or short fibered fillers, such as wood flour, asbestos and the like. In this respect, the finished product is quite similar to that obtained by Kempton except that the methods of impregnation for the production of a uniform, homogeneous mass, differ. It is the practice set forth in this patent that is referred to and criticized by Kempton as lacking in homogeneity and uniformity of strength and consistency.

Accordingly, this invention aims toward the same result sought by Kempton but Kempton professes to have made a marked improvement in the manner of impregnating and obtaining the uniform, homogeneous mass of fibers. This patent and Kempton's patent teach only that the somewhat longer fibers make for greater strength than short fibers such as asbestos and the like, in that class of fillers which are strictly fibrous in character as
123 distinguished from the spun string-like fibers referred to in this invention. There is nothing here however, to even suggest in the slightest degree the advantages which flow from the use of spun fibers of string-like form.

Examiner's Position.

The Examiner first rejected the claims on the patent to Smith No. 1,557,730 while taking the position that cutting of the yarn into "relatively short pieces" is not a patentable distinction.

The Examiner then endeavored to support his position by referring to page 5, lines 11 to 15, of the specification which states that the "invention is not limited to any particular length, etc."

The Examiner entirely ignored the fact that the cut lengths of string behave in an entirely different way from the continuous lengths of string of Smith in that flowability is provided which will enable irregular shaped articles, such as for instance, gears, to be molded to perfect shape in the mold. Gears or like articles, cannot be molded with the composition provided by Smith.

Furthermore, the Examiner ignored the fact that Smith makes no suggestion whatsoever as to any advantage resulting from cutting the string into relatively short lengths. He taught that exceptional strength would be obtained with his continuous string composition and insofar as the teachings of his specification go, the implication is that the strength is dependent upon the continuous length of string and that the desired strength would be lost if the string were cut into relatively short pieces. The Examiner refused to recognize that the applicants discovered
124 that relatively short pieces of string provide
strength substantially the same as the continuous length of string and yet would have flowability such as to enable the molding of articles of irregular shape, such as gears.

The Examiner's reference in the Official Action to Page 5, lines 11 to 15 of the specification, to the effect "this invention is not limited to any particular lengths, etc." involves the improper inference that the specification is not limited to any lengths whatsoever. This is not true, as the specification is clear that the advantages claimed for this invention are realized within the range of one-eighth of an inch up to approximately two inches in length for molding most commercial articles. The applicants point out that increased lengths decrease the flowability to some extent but that their invention covers this range of lengths.

The errors of the Examiner's position as above pointed out were clearly set forth in the following amendment but notwithstanding, the claims were again rejected and the patent to Talley was cited in addition to the patents of Kempton, Smith and Miller, which were already of record. In this rejection, the Examiner took the position that the string-like material of the present invention is apparently preferred to be in shorter lengths than that recommended by Smith and longer than the material resulting from Kempton's process of shredding impregnated canvas and that such difference is merely one of degree intermediate the two references.

In this position, the Examiner ignored the fact that Kempton refers only to fibrous material which is not, in any sense, analogous to the spun string-like material of this invention. Furthermore, the Examiner without the slightest justification stated "the result appears to
125 be practically the same as that described by the references". There is clearly no basis for this statement. The results are not the same as obtained in the references and it is contended the Examiner is in error in rejecting the claims merely on a similarity which "*appears*" to exist, when the teachings of the specification are to the contrary.

In view of the fact that the rejection is based upon what the Examiner stated "appeared" to be the facts, the next amendment was supplemented with an affidavit which clearly supported the contentions of the applicants as to the novel and advantageous character of their discovery. At this time, the claims were re-drafted in carefully selected language in the form that they now appear. The inadequacy of the references to Smith and Kempton was again pointed out.

The Examiner was urged to recognize the fact that Kempton referred only to a fibrous filler in an unspun form which filler occupies a field entirely different from that of the spun string-like material of this invention. Also that the patent to Smith made no suggestion whatsoever as to the use of relatively short lengths.

In the affidavit that was filed, results of tests were given as below which clearly show the improvement made by this invention and the differences over the references:

Tensile Strength.

Wood Flour Filler, 6000 to 7000 lbs. per square inch.

Macerated Fabric Filler (Kempton) 7000 to 8000 lbs. per square inch.

Continuous Length of String (Smith), Approximately 14000 lbs. per square inch.

Short Lengths of String, 1½ inches long, from 14000 to 15000 pounds per square inch obtained in certain tests.

126 Resistance to Fracture by Impact.

Wood Flour Filler, 2 inch pounds.
Macerated Fabric Filler (Kempton), 10 to 15 inch pounds.
Continuous Length of String (Smith), 50 to 75 inch pounds.
Short Pieces of String, (Present Invention) 50 to 75 inch pounds.

Following this amendment and affidavit, the rejection was made final. The Examiner stated the affidavit merely gives information that would be obvious from the consideration of Talley, namely, that long and strong fibrous materials give greater strength than does short and weak fiber.

In finally rejecting the claims, the Examiner completely ignored the fact that Talley merely discloses individual fibers instead of spun string-like material. He refers to relatively long fibers but an understanding of the length intended must be derived from a comparison with relatively short asbestos fibers. The fibers of Talley are the same as referred to by Kempton and the affidavit clearly shows a marked improvement over Kempton in strength obtained, to say nothing of the fact that the claims call for a string-like material and consequently were not met by Talley or Kempton.

The Examiner further ignored the fact that the claims define a material which by actual test, is as strong or stronger in tensile strength and impact resistance than that described in the Smith patent (calling for continuous string) and at the same time is flowable and moldable to form articles of irregular shape. This aspect of the invention was not mentioned by the Examiner.

Applicants' Position.

The applicants contend that the claims are clearly allowable in view of the fact that they define a new and improved invention which is nowhere disclosed nor suggested
127 in the prior art patents taken singly or collectively.

This invention enables for the first time, the production of a moldable composition and resulting molded articles having strength equal to or better than provided by laminated products or products such as Smith's which involve machining or other mechanical operations for forming irregular shapes.

By this invention, the applicants can offer the trade a molded machine gear for the first time, such as will serve for use on automobiles and like heavy duty service, without the necessity of cutting the teeth thereon in the manner of the present practice. The article resulting from this manufacture is different from an article shaped by machinery because the external surface thereof has a smooth, finished appearance provided by a coating of the binder and does not possess the raw cut edges of the filling material present when a pressed blank is machined. This fact is recognized by Talley as evidenced by the following paragraph, commencing with line 39, on Page 2, of his specification wherein he refers to a gear shaped by molding as distinguished from one made by machining.

"Gears and pinions made in the above described manner are found to have the working faces of their teeth covered with a thin layer of binder, and are thus distinguished from composite gears which are cut from composite materials containing fibrous fillers. In the latter case, the ends of the fibers are exposed on the working surfaces of the gears and may absorb oil or water while the gears are in use."

Whereas Talley's invention relates to the production of molded gears, his filling material is an unspun fiber and consequently by actual test, are much inferior in strength to the gears of this invention. A gear produced in accordance with Talley's invention is in no sense a substitute for the heavy duty gears now provided by cutting from laminated stock. 128

The language of the claims which defines the filler as "relatively short lengths of spun fibrous string-like material" is definite and clear in its meaning in view of the specification. It is clearly stated that a combination of high strength and flowability for molding are objects of this invention and that the invention does not include lengths of material which would defeat these objects. On Page 5, commencing with line 2, of the specification, it is stated:

"The essential feature is to provide a filler of string-like characteristics without limiting the invention to any particular lengths of pieces, or thickness of materials, provided only that the filling material behave in the manner taught in this invention."

Same page, in line 10, the following statement is made:

> "It is to be understood however, in this connection, that this invention is not limited to any particular lengths, the invention contemplating any and all lengths, such as will serve to produce the desired properties without destroying the flowable property of the composition.
>
> In actual experiment, yarn or twine has been employed in lengths as short as one-eighth of an inch, it being found that with this length, although the impact resistance is somewhat less than with the longer lengths, such as one-half inch, for instance, it is still surprisingly in excess of the impact resistance produced by wood flour as a filling material, or other similar, granular, powdered or finely divided filling materials. The flowable characteristic of the material is decreased as the length of the filling material is increased, but it has been found by actual test, that a good, moldable material is provided when the length of material such as 4-ply yarn, for instance, is as great as one and one-half inches. The tests have led to the belief that the composition would be suitable for molding with materials of greater length than one and one-half inches, but that the plasticity decreases rapidly for increase in lengths above one and one-half inches."

129 The terminology of the claims when construed in the light of the specification clearly comply with the requirements of Section 4888 of the Revised Statutes. As a part of the original disclosure, claim 4 specified the upper limit of length as two inches and therefore the practical range is between one-eighth of an inch and two inches.

The Examiner cannot sustain his contention that the description of length is indefinite in view of the following admission in the Examiner's Statement, on Page 1, toward the bottom of the page,

> "The pieces may be as short as an eighth of an inch, or as long as one-half inch. It is said that pieces over an inch and a half may be used, but that the plasticity decreases rapidly for increases in length above the last mentioned value."

When the references to Smith and Kempton are considered together, the Examiner is not justified in going beyond the actual teachings of their specifications. The most that can be said is that Kempton's invention may suggest that the impregnated ball of continuous string employed by Smith may thereafter be submitted to a shredding and chopping action to reduce it to a form of individual unspun fibers.

As above pointed out, Kempton's specification calls for the impregnation of sheets of fabric and the subsequent reduction of the fabric to a fibrous form. Had he had the slightest notion that the short lengths of spun fibrous string-like material would have given superior results he would not have resorted to the more troublesome and expensive procedure of reducing the fabric to its individual fibrous form. As compared to this latter operation, the cutting of short lengths of string is relatively simple and inexpensive. The answer is, that the steps of Kemp-
130 ton's process are directed solely toward what he
considers to be a better impregnation treatment of the fibrous filler. If the final product obtained by Kempton is better than Talley's product it is due to the uniformity and impregnation and not to any advantages flowing from the fibers themselves. Kempton does not teach nor suggest the idea of cutting Smith's continuous string into short lengths.

It is the applicants' position theerfore, that the claims are accurate in their language and are in avoidance of the references cited and are therefore clearly allowable.

Examiner's Statement.

In view of the fact that the Examiner reiterates in his statement, the position taken in the former rejections, it is believed that a detailed consideration of the Statement is unnecessary. However, the applicants wish to point out what they consider to be important errors in the assumptions and argument of the Examiner in supporting his rejection of the claims. He states, in Line 6, on page 2, of the Statement that;

> "The desirability of strong, long fibrous elements in molded products is well recognized."

This is true, but only in the field of fibrous fillers of the non-spun form and no teaching nor suggestion exists in the prior art regarding relatively short lengths of spun string-like material.

The reference to Miller next made, is entirely impertinent. The Examiner admits that no binder is used and this is in no sense, a moldable composition, but is merely a felted mass held in compressed condition between metallic plates.

131 In the references to Kempton and Talley, the Examiner minimizes the fact that these patents refer to non-spun fibers. It is admitted that within the field of unspun fibers, that the longer lengths give greater strength than the shorter lengths, but the improvement in strength is small and in no sense comparable to the high strength of laminated products or Smith's product, such as are obtained along with moldability, by the present invention.

In lines 24 and 25 of the Statement, the Examiner says that

> ''The expression is indefinite as to the length.''

The applicants contend that the language is clear and in full compliance with the section of the Statutes.

In line 5, from the bottom, the Examiner states:

> ''No great difference is seen between yarn cut in lengths of an eighth inch and Kempton's shredded fabric, particularly if it be duck (page 2, line 5).

In this the Examiner's position is entirely wrong. The affidavit clearly supports the fact that there is a difference in results and accordingly, the Examiner is in no sense justified in stating that no difference is ''seen''. The specification is clear as to the nature of this improvement and it is contended that the Examiner has no right to challenge the correctness of the fact statements in this specification unless there is a clear and definite reason to do so.

In the Examiner's reference to Talley he takes the position that he considers the loose and fluffy mass of fibers the same as individual pieces of string-like material and furthermore, commencing with line 3, on Page 3, of the Examiner's Statement, he states:

132 ''* * * it is considered that pieces greater than an inch and a half in length would form a tangled

mass in a mold which would be exactly the equivalent of Smith's tangled mass. There is nothing in Smith to indicate that he is to be confined to the use of one continuous piece for each filling of the mold. No essential difference is seen between a sufficient number of pieces over one and one-half inches in length to fill a small mold, and one or two pieces in a tangled mass for the same purpose."

It is respectfully urged that the Examiner's position is contrary to the teachings of the specification.

It appears to the applicants that his position resolves itself into one of doubting the correctness of the statements made in the record in spite of the fact that they are supported by an affidavit. It is clear from the specification and as supported by actual tests, that Smith's composition is not moldable so as to produce an object such as a gear, having an irregular shape, by a molding operation. This is clearly demonstrated by attempts to mold a gear from a continuous length of string which gear was displayed to your Honors at the oral Hearing.

The Examiner, without justification, takes the position that the short lengths of this invention *are exactly the equivalent of Smith's tangled mass.* There is absolutely no basis for this position. These fillers are not the equivalent as Smith's continuous string cannot be molded and the relatively short lengths of this invention are moldable while producing articles possessing the same or better strengths than those of Smith.

Finally, it is contended that the Examiner is not justified in his remark at the end of the Statement, to the effect

"Nothing in the affidavit shows any real difference over Smith, nor is there any indication that pieces of string as short as one-eighth inch are different from Kempton's shredded canvas."

133 Your Honors' attention is respectfully directed to the affidavit for an understanding of what it contains.

It should be borne in mind that Smith is not moldable and Kempton does not possess the strength. Nor will shredded canvas, which is reduced to fibrous form, serve as a reference in re*h*ecting claims calling for spun fibrous material in string-like form.

Affidavit Filed After Appeal and Examiner's Supplemental Statement.

After this appear was taken, the applicants and their attorney conferred with the Examiner for the purpose of giving him additional facts concerning this invention. As a result of this conference, an affidavit was filed giving the data of certain tests which affidavit was filed and submitted to the Examiner for consideration and comments to the Board of Appeals.

The subject matter of this affidavit can best be determined by referring to the original in the record but briefly, it may be understood that the tests there set forth show that the disposition of the string-like pieces of filling material or any other filling material are important factors in the strength of the article produced. This affidavit was filed because the Examiner had apparently considered that the length of the filling material was the major factor in strength and it was designed to show that in addition to length and character of the filling material, which of course are important, the disposition of the filling material within the molded mass is the most important factor of the three.

As applied to the present invention, the length of the filling material which is here defined as "relatively short" has its major importance in allowing the filling material to become oriented throughout the mass during the molding operation.

134 In the supplemental statement of the Examiner he has apparently misconstrued the import and significance of certain portions thereof on the grounds that the specification of this application does not give details as to how to place and dispose the string-like filling material when molding various articles.

In practice, for molding ordinary articles, such as gears and the like, the string-like filling material is not laid or placed in any particular manner but is merely introduced into the mold in a haphazard and indiscriminate way. During the molding operation, however, due to the relatively *short lengths,* the individual pieces of string are free to move under the molding pressure so as to become oriented and disposed in proper unstrained interlocking relationship with each other throughout all portions of the mold. It is this factor that makes for great strength along with the character and properties of the filling material and which produces the superior tensile strength and resistance to impact blows. It will therefore appear that this invention does not necessarily contemplate a deliberate laying of the filling material in any definite direction but that an important function of the length is that of orientation of the filling material during the molding operation.

It will further appear from this, that the applicants should not be called upon to limit their invention to any exact lengths, because the orientation of string material of any particular lengths bears a definite relationship to the size and shape of the article molded. It is believed however, that pieces of string-like material of from one-eighth of an inch up to approximately two inches will cover the range for usual commercial practice. It is respectfully urged therefore, that the Honorable Board of Appeals construe carefully, the full meaning of this affidavit and 135 the remarks of the Examiner in his Supplemental Statement.

Kempton's Article.

The applicants are attaching hereto as a part of this Brief, a photostatic copy of an article written by W. H. Kempton which appeared in the issue of February, 1932, Volume 8—No. 2 of the magazine entitled "Plastics and Molded Products." The author of this article is the Kempton of the reference cited against the claims. It is believed significant to consider the following:

The Examiner contends that the composition of this invention and the articles molded thereby are substantially the same as those disclosed in Kempton's patent. If the Examiner's position is correct, it is proper to assume that articles made in accordance with Kempton's process are suitable for the purposes of the articles of the present invention, wherefore gears molded in accordance with Kempton's invention would be equivalent in strength to laminated gears and would be capable of being substituted therefor in heavy duty service such as on automobiles and the like.

To show that this is not so, the applicants need only refer to Kempton's article which was prepared and published this year long after the invention described and claimed in his patent. It will be noted that his patent matured from an application filed March 11, 1919. Who is better qualified

to describe the characteristics of his own discovery than Kempton himself? Accordingly, Your Honors' attention is respectfully directed to the attached article, in particular the following parts thereof: First page, (62) third column, paragraph entitled, "Properties of Compound"; third paragraph, middle column, second page (63)
136 referring to "Gear Wheels"; and the paragraph entitled "Comparative Strength", second column, third page (83).

Terminology of the Claims Before the Board of Appeals.

In closing the applicants wish to point out the fact that this invention is of great commercial importance. The applicants are actively engaged in the commercial production of molded articles of various types and sorts in the field of hot and cold molding resins and they are entirely familiar with the needs and the problems existing in this art.

By this invention, the art is given for the first time, a commercial process by which heavy duty machine and other parts can be made by shaping during the molding operation.

It is believed that there can be no doubt regarding the fact that this application discloses a novel and patentable invention. It therefore remains to consider the terminology of the claims.

The position of the applicants in this regard has been fully treated above, but they would like to point out that they recognize that the Board of Appeals may not agree and may find some basis contrary to the applicants' position by which they may contend that the invention is not properly defined in the claims submitted. If such should be the case, it is respectfully urged that Your Honors make such recommendations as they deem advisable toward defining the novelty of this invention in patentable claims.

The applicants stand willing and ready to restrict the claims to spun fibrous material in string-like form ranging in lengths of from substantially one-eighth of an inch
137 to two inches. This has not been done before because it is believed that the claims are indefinite when construed in the light of the specification and in view of the further fact that the prior art does not necessitate such a limitation.

Furthermore, the spirit of the invention is perfectly clear and the behavior of certain particular lengths varies somewhat with the size and shape of the article being formed.

It is respectfully urged that the Examiner was in error in finally rejecting the claims here presented and it is prayed that the Examiner be overrules and that he be instructed to pass the case to issue.

Respectfully submitted,
WILKINSON, HUXLEY, BYRON,
& KNIGHT,
Attorneys for Applicants.

Sept. 20, 1932. Chicago, Ill.

JPH:LH.

(Here follow photolithographs, side folios 138-141.)

142 [Stamp:] U. S. Patent Office, Board of Appeals. Mailed Oct. 17, 1932.

Appeal No. 4851. Paper No. 17.

Decision.

Hearing: Sept. 22, 1932. MCV.

In the United States Patent Office.

Before the Board of Appeals.

Ex parte Oscar A. Cherry and Franz Kurath.

Application for. Patent filed Jan. 21, 1929. Serial No. 334,132. Moldable Composition of Matter and Process for Producing Same.

Messrs. Wilkinson, Huxley, Byron & Knight for applicants.

This is an appeal from the final rejection of the six claims in the case numbered 8 to 13, inclusive.

Claim 8 is illustrative and reads as follows:

8. A thermoplastic molding composition comprising a thermoplastic reactive resinous binder and a filler consisting of relatively short lengths of spun fibrous material in string-like form.

The references relied upon are:

Miller, 1,061,770, May 13, 1913,
Talley, 1,223,216, April 17, 1917,
Kempton, 1,513,323, Oct. 28, 1924,
Smith, 1,557,730, Oct. 20, 1925.

Intensive Merchandising Will Elevate Laminated Plastics to Wide Utility

By W. H. Kempton

Mr. Kempton writes with authority on both the laminated and molded branches of the plastics industry. For more than twenty years he was associated with Westinghouse, Bryant Electric and other companies in this work. In this article he contrasts the growth and future of these versatile materials.

THE specification for this article called for a discussion of the relations of molded composition or molded resinoid, and laminated resinoid, especially with reference to the market for the laminated product. In order to simplify the wording of the matter and in the absence of an official general name, the laminated product will be called "laminated" and the molded compound simply "compound". There is no intention or desire to suggest these names for general use but every time an article is written on either subject a new illustration of the need of such a name or pair of names is furnished.

This is written from the point of view obtained by many years of effort in the development of new materials of both classes to meet specific, commercial problems. These problems involved the elements of suitability and performance of material, practicability and mthods of manufacture, tool design, cost and availability of raw materials. That is to say, it included every phase of the subject up to the practical manufacture and use of the article in question. These studies covered both compound and laminated and a free choice was available as between the two classes of material.

This combined activity developed very clearly the fundamental similarity between the two products. This similarity is striking. The compound consists of fibre and phenolic resin. The laminated consists of fibre and phenolic resin. Both are formed under action of pressure and heat. From a purely material standpoint they are identical. Still, mechanically, and to a lesser extent electrically, they are widely different. An interesting phase of this question is—how is this difference brought about?

The difference is the result of manipulation of raw materials. For instance, the most common form of compound is formed of loose wood fibre and resin. The most common grade of laminated consists of wood fibre, in paper form, and resin. It is a common inference that the greater strength of the laminated is due to the fact that the paper has strength while the loose fibre has none. This is also wrong, for the strength of the paper, as paper, has little effect on the strength of the laminated product.

Properties of Laminated

The greater strength of the laminated is due to the character of the fibre and the fact that it is laid largely, in two directions, lengthwise and crosswise. The fibre, in compound, is put in place in a heterogenous manner so that it lies in all directions. That is to say, the laminated is built, with the fibre arranged to work to the best advantage to produce the maximum of strength in the desired direction to the sacrifice of strength in other directions. Laminated is weak, crosswise. The thin structure, however, usually does not find this weakness of importance. In some cases, as in punch stock, this feature has to be corrected by careful selection of paper.

In laminated the length and strength of the fibre has a great deal of effect on the strength of the finished plate. If the fibre is long and strong and is not damaged in the formation of the paper, then the plate will be strong without reference to the strength of the paper. In fact, the paper need only be strong enough to stand the strains of processing. Efforts to make the paper stronger may result in a weakened product as the fibres may be weakened in the paper making treatment.

Properties of Compound

In the compounds the permissible length of fibre is considerably restricted by the method of forming the article. Since the stock is "flowed" into place after heating, care must be taken not to interfere with the flowing property of the stock. Long fibres materially retard this flow, so only very short fibres can be used for a free flowing material. Further, the fibres are free to move in any direction, so they naturally appear at the surface. If long, the surface fibres will give a mottled or irregular finish. This problem has been so thoroughly worked out by the manufacturers of compounds that these re-

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strictions have been largely lost to sight. The older molders will recall some of the early difficulty in getting good surface finish and color.

In the making of laminated, this restriction is largely removed. The forming operation is strictly one of compression. Any kind or length of fibre can be used that can be put into sheet form. This may be done by running it into paper or by weaving it into cloth. Finish can be had by using surface sheets of fine-fibred paper while the body may be made of a strong and, relatively coarse fibre. Color may be introduced into the surface sheet only and save the cost of coloring the entire body. Designs, or even pictures, may be printed on the surface sheet and reproduced on the plate.

In comparing the two materials, the outstanding feature of the compound is the rapid production of finished pieces. The most striking feature of the laminated is the wide variety of mechanical properties, shapes and finishes, that may be obtained. In most instances, one or the other of these two classes is clearly best adapted to a given use.

Factors in Choice

If a prospective user must have a very low cost and has a large activity, compound will best meet his needs. If strength and ruggedness is the dominant need, then the laminated product will be chosen. A rayon spinning pot can be made from laminated that will have four times the strength of compound, but will cost over twice as much to make. If the cost is the dominating consideration the compound pot will be used. If strength and permanence is the main consideration then the laminated pot will be chosen. In the case of large acid trays the laminated product only could be considered on account of weight. The laminated product can be made very thin due to its great strength and toughness.

The compound does not always win out on the cost basis. A process of molding a cover on electrical condensers has been developed and used. An attempt was made to apply them to radio sets but lost to the condenser made from laminated. A construction was developed to permit the use of laminated punchings that gave a cost far below the molded condenser. Large quantities of this type have been made.

Airplane propellers can be made from either compound or laminated stock. The former has never reached beyond a few experiments while very successful propellers have been made in quantity from the laminated material. In this case the strength requirements leave no choice as between the two materials.

Gear wheels can readily be molded from compound or laminated. Only the lightest of service can use the compound gear. The laminated gear is used in large numbers and for a wide variety of service.

Many examples might be given where either material can be fabricated into the part under consideration. In most instances a knowledge of the performance requirements will immediately determine which material must be chosen. In but few cases will the two materials come into conflict. They make a good working team that will widen the market for the manufacturer who is equipped to furnish both.

The compound field is much better known as it has, for some reason, been developed much more energetically than has the laminated. The uses number many thousand already and it is still in "low gear". Who can say where it will go when it is shifted to "second" and "high"?

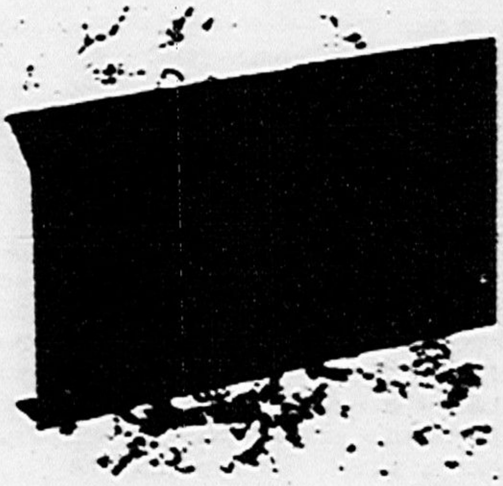
Uses of the laminated product have been given, relatively, scant attention. The reason why this is so is not so clear, but it may be the manufacturers of this material soon picked up a good profitable load and became satisfied, so did not extend their efforts further. Another element may be that the number of manufacturers is considerably less than in case of compound. The reason for this may be the great cost of setting up for the manufacture, the more difficult technique and fewer trained men available. It is quite certain that the profit has been much better in the laminated than in the compound field.

Marketing Possibilities

So far it has been the purpose to show how closely allied are the two products, from a raw materials viewpoint but how different, in finished characteristics. The rest of the discussion will have to do with the future possibilities of laminated products.

The method used for varying the mechanical quality of the laminated has already been mentioned. The comparison of

(Continued on page 83)



A new application in the phenolic laminating field is this baseboard developed of molded sheet-stock by the Panelyte Corporation. It is made in various colors and wood effects, and is mold-shaped at top and bottom to form a hollow space through which electrical wiring, conduits and telephone lines may be run. Top edge is bevelled to form a tight fit against the wall, and is slanted to prevent dust and dirt from collecting on the top surface. The lustrous, permanent finish resists the discoloring which results on ordinary baseboards from contact with brooms and mops. It is sold in pre-determined lengths or can be obtained by the foot and sawed like lumber.

[illegible]

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fore, that with some of the grades characterized by their hardness, and also with thick stock of any grade, a pre-heating improves punching. In fact, in some cases, preheating makes punching possible. It is almost impossible to lay down a definite schedule of temperatures, these varying according to the piece to be punched, the material used, and its thickness. They range, however, from a slight warming to a heat of about 250 degrees F. as a maximum. It will be found that any punch press operator with average intelligence will, with a little varying of his heat, easily find the best temperature for the stock he is using, the ideal temperature being the lowest he can use and still obtain satisfactory results.

Preheating Methods

Preheating can be handled by the use of ovens or else hot plates conveniently located beside the punch press, and within reach of the operator. Strips to be punched should be heated and punched in rotation as a too lengthy heating will cause a tendency to brittleness in the material.

In designing punched parts, it is advisable wherever possible to allow between the edges of holes and the edges of the punched piece, or between the edges of adjacent holes, an amount of stock at least equal to the thickness of the stock. Also, if possible, holes should not be of a smaller diameter than the thickness of the stock to be punched. The latter is not essential but is merely desirable.

Tapping

When tapping holes, they should be drilled slightly larger than would be required if the material were metal. Either use a larger drill or else a drill of correct size, but ground somewhat off center, otherwise the operation is the same as for metal. Turpentine or light oils may be used to improve the threads.

Threading

The threading of laminated phenolic materials, when in lathes, should be accomplished with tools ground without rake but with plenty of clearance. Self-opening dies may be used if desired. Tools must be kept very sharp and the use of turpentine or a light oil will assist greatly in obtaining clean threads. Threads may be cleaned by using a fine wire brush or a stiff hair brush.

The foregoing describes a rather general technique which has been found to give satisfactory results. A slight variation of treatment may be found to be desirable according to the grade of material being handled, but any machinist with reasonable experience and a little imagination will have no difficulty at all in making such slight changes as are necessary for the easiest and most efficient handling of whatever grade of laminated phenolic material he may be using.

Marketing Laminated Plastics

(*Continued from page 63*)

results will be striking to those not familiar with the laminated. Mechanical qualities only are being discussed as it is the mechanical uses that will supply the big volume of future business to a far greater extent than has been the case with compound.

Comparative Strength

In general, the weakest grade of laminated is stronger than the strongest grade of compound. The spread from the weakest to the strongest grades of laminated is much greater than the similar spread of compounds. The transverse or bending strength of laminated can be made as high as mild steel. One grade of material was made with a bending strength of nearly 40,000 pounds per square inch. That, however, was the result of an unusually pressing situation. It is a story in itself. The material served its purpose and passed out, like an actor on the stage.

By manipuation of the fibre in the sheet, a wide variety of mechanical properties can be secured. By manipuation of the treated sheet, a wide variety of sizes and shapes of products can be obtained. Plate is now made in four by eight feet in size. A method of multiplying the length of the plate to nearly any extent has been worked out. Trays and pans with rims have been made in large quantities. It would not take a very strong imagination to see a complete door surface formed in one piece. The head piece of a bedstead could be made of simple steel construction and covered by a continuous plate of formed, laminated stock.

Consider a row boat or canoe. The big problem is to protect the body material from the water by paint or other substance. Make the body from a strong, tough, laminated stock, formed to shape, and little protection will be needed. Laminated is an ideal finishing material for large boats or any other structure that is exposed to extremes of moist air. Aircraft is a natural field of use for this material and it is certain to have a big place in future production programs when some manufacturer gives proper study to the subject. Bodies and body parts, pontoons, control vanes, all such parts could be greatly improved by applying this material, with proper adaptation to the articular needs of such parts.

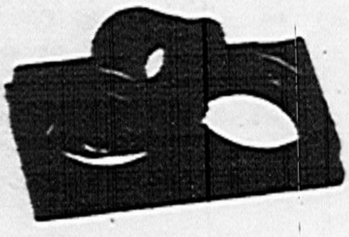
Some Present Uses

Floor surfaces, window sills, chair bottoms, desk tops, table tops, panels, all these and scores of other places are possible big markets for this product. Why it is not used more at this time, is difficult to understand. In developing new uses and adapting the product to such uses, the compound people have been far

78

AMERICAN RECORD CORPORATION

Complicated Molded Parts Receive Competent Attention



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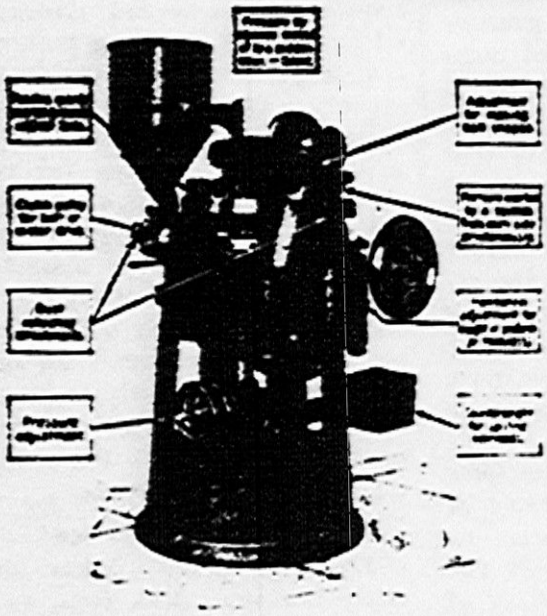

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more energetic and successful than the laminated group.

Type Cases

Unless the present manufacturers take a more energetic attitude toward the subject of new uses, it is very likely the prospective user will develop the manufacture in his own plant. In one case, one of the laminators sent a representative to call on two of the largest users of a certain article, to learn if they would be interested in having it made from laminated. Both were deeply interested and one was on the verge of starting his own force on that identical problem. He was very willing to drop the matter, if the laminator would agree to push the work actively. It has since become a large and profitable account to him. In another case, a company, not in position to do the work for itself, came to a laminator and offered to pay for all the development if they would try to make the article from laminated to their specifications. This article has also become a valuable business and is being sold to a large number of customers. Other laminators are now taking it up.

A much better attitude for the laminators would be to canvass all fields so thoroughly that no possible user would have to search them out. The possible range of uses for laminated is much wider than for compounds and the prospective business a great deal larger. This larger activity will facilitate the lower cost necessary to secure the big volume of business. Methods of reducing the cost are being studied keenly. Raw material costs are coming down and ways of using cheaper ingredients are being found.

All that is needed to put the laminated product over big, is more courage on the part of manufacturers in going through with big development programs. The field is ready and waiting for anybody with enough courage to occupy it.

The alleged invention relates to a moldable composition of matter and process for producing the same. Its nature is clearly set forth in the examiner's statement as follows:

> The claims relate to a moldable composition using a thermoplastic heat hardenable artificial resin as the binder. With such resins there is ordinarily used an approximately equal quantity of filler. The filler may be a powdered mineral substance such as clay, slate talc etc. or it may 143 be a fibrous filler, the usual examples of which are cotton flock, wood meal or asbestos fibre. The particular distinction here is said to reside in the use of "relatively short lengths of spun fibrous material in stringlike form." The description refers to the use of yarn such as four ply cotton yarn. The pieces may be as short as an eighth of an inch, or as long as one half inch. It is said that pieces over an inch and a half may be used, but that the plasticity decreases rapidly for increases in length above the last mentioned value. The advantage in the use of pieces of yarn in place of ordinary fibre is said to be in a greatly increased strength of the resultant molded article, particularly the impact strength. It is said that all materials of a "stringlike nature" give the advantage. It is indicated that pieces of a half inch length yield stronger articles than those of an eighth inch in length. The resin is incorporated with this filler by impregnating or coating the twine with the resin and then cutting the twine into short lengths.
>
> The examiner points out that Kempton was working on the same problem as appellants and impregnated canvas with a resin, then shredded the canvas to provide long cotton fibres, thereby obtaining a moldable composition alleged to produce a much stronger product due to the long cotton fibres. Kempton's specification states that he dries the product impregnated with a phenolic condensation product in liquid form, and then comminutes the sheet material to provide a fluffy mass of moldable composition, and that this comminution may be obtained by grinding the fabric, shredding it or chopping it up.
>
> The patent to Talley relates to the same problem and uses fibrous material having long fibres.
>
> Smith attempted to solve the problem by impregnating balls or spools of yarn with a resin under pressure and then placing the yarn in a tangled mass in the mold.

Appellants state that they preferably use short lengths of spun fibrous material in string-like form, ranging in length from one eighth of an inch to one inch and a half. The patents to Smith and Kempton apparently use the same or similar material. The contention of appellant that in Kempton the material is too short and not string-
144 like and that the string used by Smith is too long to
effect the best results or anticipate the claims, is believed to relate merely to an unpatentable matter of degree.

The brief of appellants, the contentions made therein, and the affidavits filed in support thereof have been carefully considered without finding reversible error in the examiner's action.

The decision of the examiner is affirmed.

F. M. HOPKINS,
Assistant Commissioner,
W. S. RUCKMAN,
Examiner-in-Chief,
EUGENE LANDERS,
Examiner-in-Chief,
Board of Appeals.

October 17, 1932.

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145 Address only the Commissioner of Patents, Washington, D. C.

Department of Commerce, United States Patent Office,
Washington.

Ex parte Oscar A. Cherry and Franz Kurath. Serial No. 334,132. Filed January 21, 1929. Moldable Composition of Matter and Process for Producing Same

Notice of Suit Under Section 4915 R. S.

A suit in Equity under Section 4915 R. S., entitled Economy Fuse and Manufacturing Company, Plaintiff, vs. Thomas E. Robertson, Commissioner of Patents, Defendant, Equity No. 55,555, involving this application, was filed on April 13, 1933, in the Supreme Court of the District of Columbia.

T. A. HOSTETLER,
Solicitor.

April 13, 1933.

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CONTENTS:

1. *Application* ____________ *papers.*
2. Rejection SEP 13 1929
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4. Rejection DEC 13 1930
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6. Final Rejection JAN 15 1932
7. Appeal Feb 8/1932
8. Exrs Statement
9. HEARING. JUL 22 1932
10. Hearing postponed to Sept. 14/32
11. Affidavit [illegible] 1915
12. Remanded to the Examiner July 20-1932
13. Supplemental Answer July 26/1932
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15. Hearing postponed to Sept 22/32
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16.
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18. Notice of Suit under Sec. 4915 R.S. - April 13, 1933
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20. Not up for Action
21. Do not hold Abandoned
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Feb. 7, 1933. O. A. CHERRY 1,896,070

MOLDED GEAR

Filed June 17, 1931

Fig. 1.

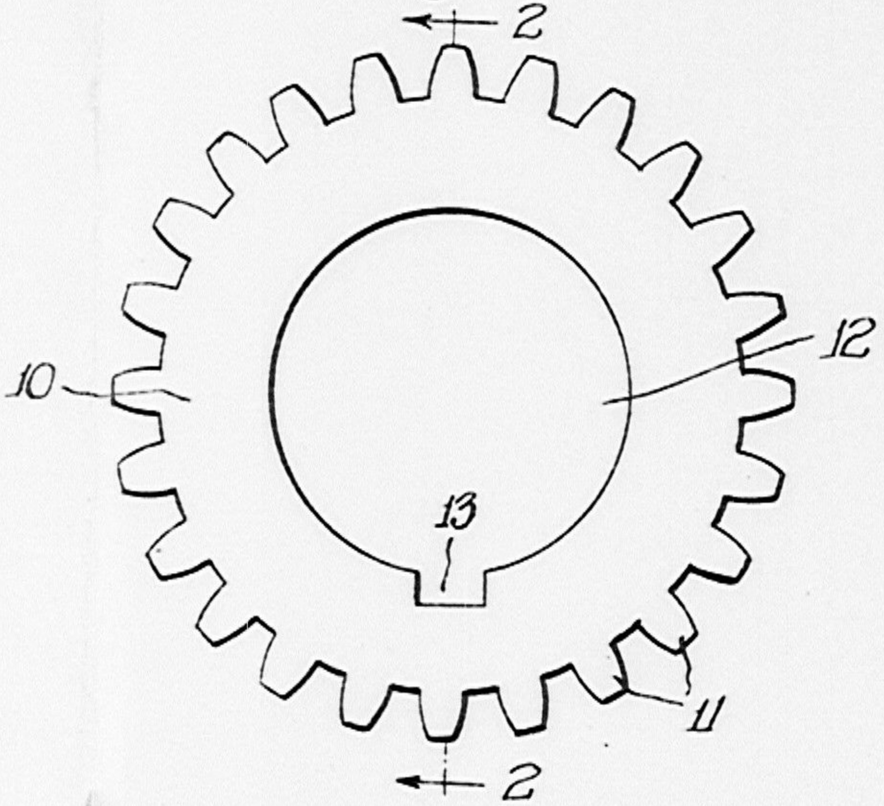
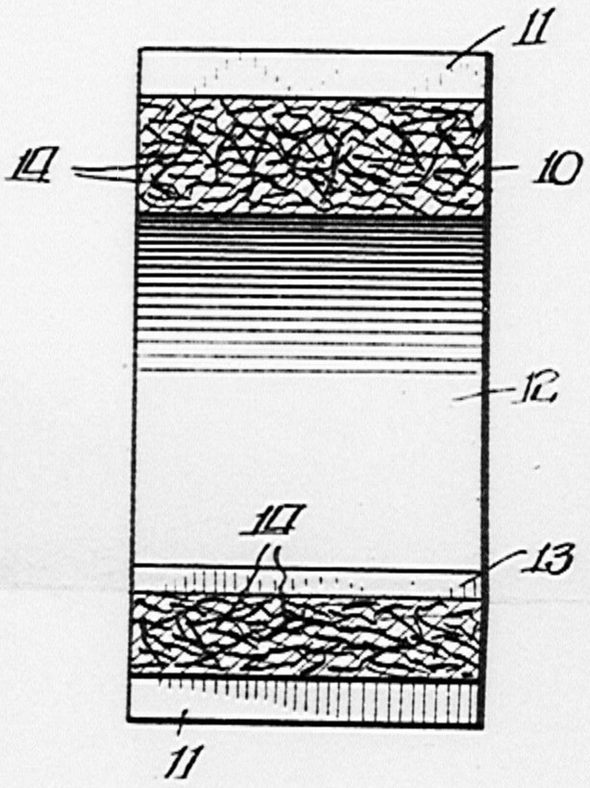


Fig. 2.



Inventor:
Oscar A Cherry,
By Wilkinson, Huxley, Byron, & Knight Attys.

Patented Feb. 7, 1933 1,896,070

UNITED STATES PATENT OFFICE

OSCAR A. CHERRY, OF CHICAGO, ILLINOIS, ASSIGNOR TO ECONOMY FUSE AND MANUFACTURING COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF NEW YORK

MOLDED GEAR

Application filed June 17, 1931. Serial No. 545,081.

This invention relates to improvements in a molded gear or similar article formed from a composition consisting of a thermoplastic reactive resinous binder and a filler.

It is an object of the invention to disclose an improved molded gear which does not require machining of the gear teeth after molding and which will have a high degree of mechanical strength.

It is further an object of the invention to disclose a molded gear formed from a composition consisting of a thermoplastic reactive resinous binder and a filler consisting of relatively short pieces of spun fibrous string-like material.

Further objects and advantages will be more readily apparent from the following detailed description.

It has been common practice in the manufacture of molded gears to employ a laminated construction consisting of built-up layers of fabric and a resinous binder pressed and reacted in a mold but such a method will not permit flowing of the material during molding and it is therefore impossible to mold the gear teeth. It is necessary in this method to first form a molded blank and subsequently machine the gear teeth.

It is highly desirable for purposes of economy in manufacture to mold a gear directly from a molding composition which will flow in the mold in such a manner as to form the gear teeth. However, such moldable compositions as have been previously proposed which have the desired characteristics of flowability will not provide sufficient strength and shock resistance in the finished gear.

It has been suggested to use scrap fabric as a filler material which has been coated or impregnated with a resinous binder and although such a composition may be readily moldable to the desired shape, the tensile strength is found to be not materially greater than articles molded from a filler of wood flour or asbestos together with a resinous binder.

I have found that a satisfactory molding composition for use in the manufacture of gears is obtained by utilizing relatively short pieces of string-like material, such as twine or yarn, which retains its characteristics of spun and twisted fibers in the molded article. The string-like material is previously coated or impregnated with a thermoplastic reactive resinous binder and an intermingled mass of the material is placed in a mold and under the action of heat and pressure flows to form the gear while the resinous binder reacts to an infusible and insoluble binding body.

For example, a continuous length of yarn, such as cotton twine, may be coated or impregnated with a potentially reactive phenolic condensation product and after drying, the yarn or twine may be cut into short lengths whereby a molding composition, having a high degree of thermoplastic flow, is obtained. According to a preferred form, the yarn or twine may be cut into lengths from 1 to 1½ inches, but it is to be understood that shorter or longer lengths may be employed if so desired. The relative proportions of the filler and the resin in the composition may be approximately 60% filler and 40% resin, since it is found that the most satisfactory results are obtained when only sufficient resin is present to form a lubricant and a binder between the pieces of string. The resin, in acting as a lubricant, keeps the string filler out of frictional contact to permit flowability during molding. The resin during molding, after application of a sufficiently high temperature, reacts to an infusible and insoluble binding body.

The gear may be molded in a plunger mold in which the movable plunger is formed with gear teeth cooperating with internal gear teeth in the fixed part of the mold. In this form, substantially vertical compression only is required since the cross section of the plunger is the same as the gear to be molded. In another form the plunger may be smaller than the gear and have a simple cylindrical shape and the moldable composition is caused to flow outwardly by the vertical pressure of the plunger to form gear teeth in the fixed part of the mold. Substantially 30 to 80 pounds steam pressure is found to be sufficient in molding a gear having a 2½ inch face.

To assist in understanding this invention, a gear made in accordance with this disclosure is illustrated in the accompanying drawing, in which Figure 1 is a side elevation of a gear molded in the above described manner and, Figure 2 is a cross sectional view taken on the line 2—2 of Figure 1 and looking in the direction of the arrows. From the drawing, it will be noted that gear 10 is of any desired construction, that is of the usual form, having the gear teeth 11 molded thereon. It is preferable to provide a core 12 and in some instances, a keyway 13. All of these characteristics of the gear may be molded so as to eliminate the necessity for machining after the molding operation.

In the cross sectional figure, the molded spun fiber strings are diagrammatically represented at 14. Of course this figure does not show the exact arrangement or the quantity of string but illustrates merely that the gear is made up of the multiplicity of spun fibrous string-like pieces of short length in accordance with the above description.

The gear molded according to the method described does not require any subsequent machining and the mechanical strength is found to be comparable with molded gears of the laminated type. The tensile strength is found to be on the average of from 14,000 to 15,000 pounds per square inch and a maximum tensile strength of 18,000 pounds per square inch has been obtained. The resistance to fracture by impact is found, upon test, to be from 50 to 75 inch pounds.

I claim:

1. A toothed gear molded in situ and comprising a reacted phenolic condensation binder and a filler consisting of relatively short lengths of spun fibrous string-like material.

2. A toothed gear molded in situ and comprising an infusible and insoluble resinous binder and a filler consisting of relatively short lengths of spun fibrous string-like material.

3. A toothed gear molded in situ and comprising an infusible and insoluble resinous binder and a filler consisting of an intermingled mass of relatively short lengths of spun fibrous strings.

4. A toothed gear molded in situ and comprising an infusible and insoluble resinous binder and a filler consisting of pieces of spun fibrous string-like material in length between 1 and 1½ inches.

5. A toothed gear molded in situ and formed from a composition consisting of a thermoplastic reactive resin and a filler consisting of relatively short lengths of spun fibrous string-like material.

6. A toothed gear molded in situ and formed from a composition consisting of a potentially reactive phenolic condensation binder and a filler consisting of relatively short lengths of spun fibrous string-like material coated with the binder.

7. A toothed gear molded in situ and consisting of substantially 40% of an infusible and insoluble resinous binder and substantially 60% of a filler consisting of a plurality of short pieces of fibrous string material between 1 and 1½ inches in length.

Signed at Chicago, Illinois, this 15th day of June, 1931.

OSCAR A. CHERRY.

152 Economy Fuse and Manufacturing Company

vs.

Coe.

Equity No. 55,555.

A—Miller, 1,061,770.
B—Talley, 1,223,216.
C—Kempton, 1,513,323.
D—Smith, 1,557,730.
E—Article on "Fillers", in "Synthetic Resins and Their Plastics", by Carleton Ellis, published by The Chemical Catalogue Company, Inc., Pages 378-380.
F—Examiner's Statement.
G—Examiner's Supplemental Statement.
H—Decision of Board of Appeals.

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J. MILLER.
GEAR WHEEL.
APPLICATION FILED JUNE 27, 1911.

1,061,770. Patented May 13, 1913.

Fig. 1.

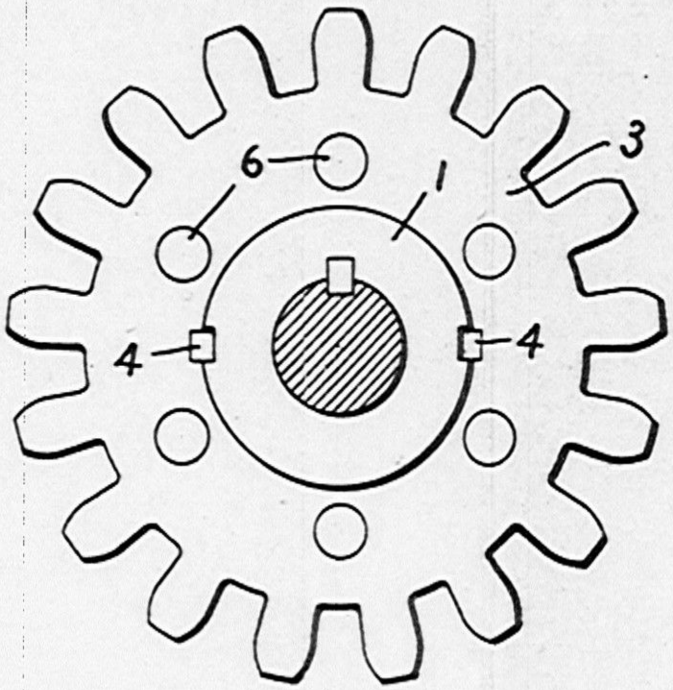
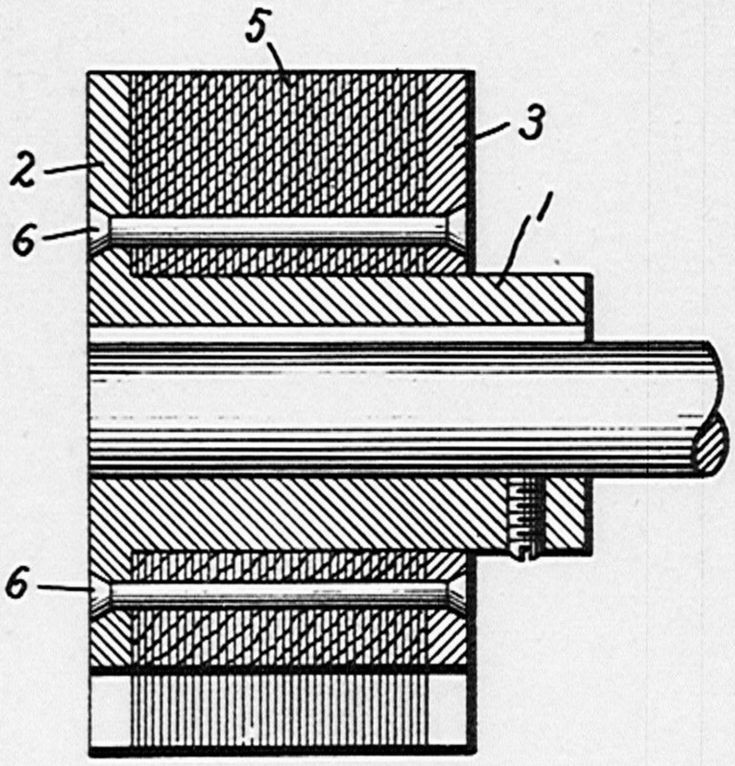


Fig. 2.



Witnesses:
Earl G. Klock.
J. Ellis Glen.

Inventor:
John Miller,
by Albert G. Davis
His Attorney.

UNITED STATES PATENT OFFICE.

JOHN MILLER, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

GEAR-WHEEL.

1,061,770. Specification of Letters Patent. Patented May 13, 1913.

Continuation of application Serial No. 507.097, filed July 12, 1909. This application filed June 27, 1911. Serial No. 635,655.

To all whom it may concern:

Be it known that I, John Miller, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Gear-Wheels, (continuation of my prior application, Serial No. 507,097, filed July 12, 1909,) of which the following is a specification.

The object of my invention is to provide a noiseless or non-resonant pinion or gear-wheel which shall be stronger and more durable than devices heretofore on the market designed to accomplish the same function.

Noiseless pinions or gear-wheels have previously been made of layers of leather, rawhide, paper or indurated fiber, but pinions or gear-wheels made of these materials are objectionable for they deteriorate rapidly in use, shrink and swell according to the amount of oil or moisture absorbed and are easily stripped of their teeth. It has been proposed to interpose between layers of these various materials, sheets of metal to sustain the stresses imposed upon the teeth, but such interposed sheets of harder material are highly objectionable in that they cut and destroy the smooth sliding surfaces of the teeth of the gears meshing therewith, and only partially overcome the objections to the ordinary gear.

I have discovered that pinions or gear-wheels made up of spinnable textile fibers highly compressed are stronger, more durable, do not shrink or swell and are altogether superior to any of the other kinds of noiseless pinions or gears produced up to the present time.

In the accompanying drawing, Figure 1 shows in end elevation and Fig. 2 in transverse section a pinion made in accordance with my invention.

As shown in the drawing, the gear consists of a hub 1 in the form of a sleeve adapted to be keyed to a shaft and having at one end an integral plate 2, while at the opposite end I provide a loose plate or disk 3 having keys 4 in engagement with the hub 1. Between the radial plates 2 and 3 is a mass of spinnable textile fibers 5 highly compressed and secured in compressed state by longitudinal bolts or rivets 6 headed in countersunk holes in the plates 2 and 3. The expression "spinnable textile fibers" is used in this specification to collectively designate the various fibers of the class that have been commonly used in making yarns and in the fabrication of cloth, which are characterized by pliability, strength and long spinnable staple, as, for example, cotton, flax, hemp, ramie, wool and silk. Spinnable textile fibers may be subjected to a high degree of compression without destroying or impairing their characteristic properties and when a mass of such fibers is compressed each fiber is in frictional contact with a multitude of other fibers, which affords great cohesiveness to the mass and great resistance to disturbance of the fibers relative to each other under stresses such as are imposed upon the teeth of a gear.

In order to insure uniform distribution of the textile fibers, I prefer to cut circular disks from a batten or layer of the fibers and stack them one above the other in the press by which they are compressed. I have also used with success textile materials in the form of woven fabrics, cut into circular blanks and stacked, as above set forth.

After the textile body of the gear has been compressed to the proper degree between the metallic end plates and the compression-sustaining means secured, the gear blank thus formed may be removed from the press and turned and milled according to the practice in making metallic gears.

I do not desire to restrict myself to the particular form or arrangement of parts herein shown and described, since it is apparent that they may be changed or modified without departing from the spirit of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. A gear having its body portion composed of highly compressed spinnable textile fibers.

2. A gear having a toothed body part composed of spinnable textile fibers.

3. A gear composed of compressed spinnable textile fibers, and means for holding said material in compressed state.

4. A gear having a toothed body part

composed of spinnable textile fibers, metallic end plates, and means for securing said textile material and said end plates together.

5. A gear having its toothed body portion composed of layers of spinnable textile fibers.

6. A gear having its toothed body portion composed of layers of textile fabric made of spun yarn.

In witness whereof, I have hereunto set my hand this 23rd day of June, 1911.

JOHN MILLER.

Witnesses:

BENJAMIN B. HULL,
MARGARET E. WOOLLEY.

UNITED STATES PATENT OFFICE.

RANDAL E. TALLEY, OF IRWIN, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

GEAR.

1,223,216. Specification of Letters Patent. **Patented Apr. 17, 1917.**

No Drawing. Application filed December 9, 1916. Serial No. 136,025.

To all whom it may concern:

Be it known that I, Randal E. Talley, a citizen of the United States, and a resident of Irwin, in the county of Westmoreland and State of Pennsylvania, have invented a new and useful Improvement in Gears, of which the following is a specification.

My invention relates to composite gear wheels, pinions and other machine elements, and it has for its object to provide machine elements of this character which shall be noiseless in operation and highly resistant, under operating conditions, to the effects of heat, oil and mechanical shocks.

In the patents to Conrad, 1,167,742 and 1,167,743, is described and claimed a new class of gearing composed wholly, or in part, of a strong and durable mixture of fibrous material and a binder. The gears therein shown consist specifically of laminations of paper or cloth impregnated with a binder and united under such conditions as to form a hard, infusible and substantially insoluble integral mass. My present invention aims to produce gears and other machine elements of the same general type as those described in the above-mentioned patents, and it has particular relation to the manufacture of such machine elements by molding methods.

Resinous condensation products produced by reaction between phenolic substances and substances containing active replaceable methylene groups, such as formaldehyde and hexamethylene-tetramin, have been applied to many uses, either alone or in combination with various fillers. It has been proposed to mold gears from materials of this kind, but it has heretofore been considered, presumably on account of the relatively low tensile strength of these resins, that the resins or compositions containing them must be combined with metallic end plates or other reinforcing members in order to produce gears having the requisite mechanical strength. The fillers which have been suggested for use in admixture with phenolic resins for the manufacture of gears have been either non-fibrous in character or, if fibrous, have consisted of wood flour, asbestos and other short fibers having little or no interlocking power.

I have discovered that, if phenolic resins or other binders are intimately mixed with fibrous materials having long fibers and are molded under the proper conditions, gears and other machine elements may be produced having working body portions which are entirely self-sustaining under the conditions of service and which, therefore, require no end plates or other reinforcement. Many kinds of fibrous materials are suitable for my purpose, such as long and short staple raw cotton, hemp and other textile fibers, as well as certain varieties of long-fiber asbestos. Ordinary asbestos is not suitable for my purpose, not only because of the short and weak material of its fibers but on account of its abrasive properties which render composite gears made from asbestos unsuitable for meshing with metallic gears.

The fibrous material and the binder may be mixed together in any suitable way and in various proportions. For example, the binder may be dissolved in a solvent and the fibers may be immersed in the solution, the excess of solution being squeezed out by means of suitable rollers and the mass heated sufficiently to drive off the solvent. If phenolic condensation products, in their soluble stage, are used as binders, methyl alcohol may suitably be employed as the solvent. The binder may also be applied to the fibrous material in the form of powder sprinkled among the fibers.

Another method of uniformly mixing the binder with the fibrous material consists in first crushing the binder and then tumbling it with water in a ball mill until it is finally pulverized and suspended in the water in the form of an emulsion. The fibrous material is then introduced into this emulsion and thoroughly agitated in a ball mill or otherwise, in order to mix the fibers and the binder uniformly together. The water is then drained off, and the mass of fibrous material and binder is dried, producing evenly mixed material which is well suited to molding operations in general, as well as to the production of gears and other machine elements.

As indicated above, the proportions of the materials comprising my molded machine elements may be considerably varied. If phenolic condensation products are used as binders in connection with cotton fibers, the proportions of these materials may suitably be about 10 parts by weight of the fibers and 6 parts by weight of the binder.

The molding material prepared in the manner described above is formed into gear wheels, pinions and other machine elements by compression in a hot mold according to the methods well known in the molding art. The molds should be cut with the greatest possible accuracy, in which case, the resulting gears, in addition to being exactly alike, are more accurately shaped than gears which are cut by ordinary milling methods.

In order to economize labor and time in the manufacture of these gears, I prefer to mold them in multiple, which may be accomplished, when gear wheels are to be molded, either by providing a mold with several dies arranged side by side and adapted to be operated upon by a single stroke of a molding press, or by providing a tall mold of a cross section corresponding to the contour of a single gear and forming a series of gears therein at a single operation. In the latter instance, sufficient molding material to form one gear is placed upon the mold, a steel plate or other suitable partition is placed upon this material and another portion of molding material is placed upon the plate, the alternate arrangement of molding material and separating plates being continued to the top of the mold and pressure being applied to the entire stack by a single compression of the molding plunger. It will, of course, be understood that the proper amount of molding material for each gear is carefully weighed preparatory to the molding operation.

Gears and pinions made in the above-described manner are found to have the working faces of their teeth covered with a thin layer of binder, and are thus distinguished from composite gears which are cut from composite materials containing fibrous fillers. In the latter case, the ends of the fibers are exposed on the working surfaces of the gears and may absorb oil or water while the gears are in use.

My composite gears may be handled and used in all respects like metal gears. Since these gears are highly resistant to the effects of heat, oil and moisture, they do not deteriorate or become warped in use as do such materials as raw hide, leather, fiber and the like. These gears are also self-lubricating to a considerable degree.

While I have specifically mentioned the use of phenolic condensation products as suitable binders for use in the manufacture of my molded gears, it is to be understood that other binders may be utilized for this purpose such, for example, as shellac, copal, and other binders which will produce firm, self-sustaining and wear-resisting gears and which will not be injuriously affected by operating conditions. It is to be understood that my invention includes the use of such other binders, as well as all modifications in materials and methods which fall within the scope of the appended claims.

I claim as my invention:

1. A machine element having a molded working body portion comprising a non-abrasive fibrous material and a binder.

2. A gear having a molded working body portion comprising a non-abrasive fibrous material and a binder.

3. A gear having a self-sustaining molded working body portion comprising a non-abrasive fibrous material and a binder.

4. A molded gear composed of textile fibrous material and a binder and a film coating on its working faces.

5. A molded gear composed of cotton fibers and a binder.

6. A gear having a molded working body portion comprising a non-abrasive fibrous material and a phenolic condensation product.

7. A gear having a self-sustaining molded working body portion comprising a non-abrasive fibrous material and a binder comprising a phenolic condensation product.

8. A molded gear composed of textile fibrous material and a binder comprising a phenolic condensation product.

9. A molded gear composed of cotton fibers and a binder comprising phenolic condensation products.

10. A molded gear composed of a fibrous material and a binder, a portion of which constitutes a complete coating to resist attacks by heat, oil or water under operating conditions.

11. A molded gear composed of fibrous material and a binder that is unimpaired by operating temperatures.

In testimony whereof, I have hereunto subscribed my name this 27th day of Nov. 1916.

RANDAL E. TALLEY.

Patented Oct. 28, 1924. **1,513,323**

UNITED STATES PATENT OFFICE.

WILLARD H. KEMPTON, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

MOLDABLE COMPOSITION AND METHOD OF MAKING THE SAME.

No Drawing. Application filed March 11, 1919. Serial No. 281,907.

To all whom it may concern:

Be it known that I, WILLARD H. KEMPTON, a citizen of the United States, and a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Moldable Compositions and Methods of Making the Same, of which the following is a specification.

My invention relates to moldable compositions and more particularly to compositions comprising fibrous material impregnated with a suitable binder, such as shellac or one of the numerous shellac substitutes as, for example, a phenolic condensation product.

Heretofore, numerous articles employed in the electric and other arts have been made of moldable compositions comprising a suitable filler impregnated with a phenolic condensation product, such as bakelite, as a binder. In most cases, the filler employed has been either a granular or powdered filler, such as wood flour, cork or the like, a short-fibre filler, such as comminuted asbestos, or a laminated filler, comprising superimposed layers of fibrous sheet material, such as paper, duck, or other fabric.

Such fillers, when treated with a binder, of the character specified, and cured properly, as by the application of heat and pressure, are very satisfactory for certain purposes. However, a comminuted filler, such as wood flour, or a short-fibre filler, such as comminuted asbestos, does not possess sufficient strength for some purposes although its strength is relatively uniform. On the other hand, a body comprising superimposed layers of fibrous sheet material and a hardened phenolic condensation product possesses unusually great mechanical strength in one direction but does not possess as great strength as is required, in some instances, in an opposite direction. Also, the sheet material may be conveniently formed into bodies of uniform thickness only.

To overcome these objections, attempts have been made, by various methods, to provide a moldable composition comprising long fibres, and particularly long cotton fibres, impregnated with a suitable binder, such as a phenolic condensation product, as it has been appreciated that a body molded from such material would possess uniform strength, in all directions, and a strength considerably exceeding that of moldable compositions having a granular or short-fibre filler. Furthermore, such a moldable mixture may be readily formed into bodies of irregular thickness.

Previously, no such composition has been devised, to the best of my knowledge. For example, if a phenolic condensation product, such as bakelite, is powdered, by itself or with any other powdered binder, and is mixed with long cotton fibres, in a dry mixing mill, the fibres merely wad up into lumps into which the powdered material cannot be driven uniformly. Because of this, articles molded from such material possess no uniformity, either in composition or strength.

Another method, which has been practised, has been to add the binder, in the form of a liquid or a solution, to the cotton fibre. When this is done, the impregnated fibre may be uniformly dried only with the greatest difficulty and, when dried, it is so heavy and lumpy that it must be ground in a mill, or other suitable machine, to sufficiently disintegrate it so that its fibres may be scattered to produce a uniform body. This grinding of the lumped fibres, however, largely destroys them so that the strength of articles molded from them is materially reduced. For this reason, it has heretofore been practically impossible to provide a moldable composition comprising long, loose fibres, of cotton or other material, uniformly impregnated with a binder, such as a phenolic condensation product.

The primary object of my invention resides in the provision of a simple, economical and efficient method of providing a moldable composition, of the desired character, in which the filler shall comprise undamaged, long fibres, of cotton or other material.

I have found that woven fabrics, in sheet form, such as various forms of cloth, may be readily and uniformly impregnated with a phenolic condensation product, in liquid form or in solution, and may then be dried without changing the character of the binder employed. The impregnated sheet material may then be shredded, chopped up, ground or otherwise comminuted to provide a loose, fluffy mass of long fibres which are substantially uniformly impregnated with the binder employed.

In practising my invention, I may impregnate a fabric or woven sheet material, of cotton or other fibre, such as duck, muslin or the like, with a suitable percentage of a phenolic condensation product, in liquid form or in a solution, and dry the impregnated sheet material, at a relatively low temperature. The sheet material is then comminuted in any suitable manner to provide the desired, fluffy mass of moldable composition. This may be done by grinding the fabric, shredding it or chopping it up as preferred.

Obviously, linen, hemp and other fibres may be employed as well as cotton fibres, or mixtures of several kinds of fibres may be utilized. Furthermore, pieces of fibrous sheet material, remaining after cutting blanks from impregnated sheets for use in the manufacture of laminated bodies, may be scrapped or shredded to provide my moldable composition and it is thus possible to utilize material which has heretofore been wasted. It will, therefore, be understood that no limitations are to be imposed upon my invention other than those necessitated by the prior art or specifically indicated in the claims.

I claim as my invention:

1. A moldable composition consisting of a phenolic condensation-impregnated woven fabric, in comminuted form.

2. A moldable composition consisting of a phenolic condensation-impregnated long-fibred sheet material, in comminuted or shredded form.

3. A moldable composition consisting of a phenolic condensation-impregnated duck, in finely divided form.

4. A molded material comprising a heat compacted mass of shredded sheet material having a coating of thermoplastic binder.

5. The method of making molded material which consists in coating fibrous material in sheet form with a thermoplastic material, then subdividing said sheet material and finally molding the product under heat and pressure.

6. The method of making moldable mixtures which comprises coating fibrous sheet material with a phenolic condensation product and subdividing said sheet material.

7. The method of making moldable mixtures which comprises coating fibrous sheet material with a solution of a thermo-plastic binder, and drying and subdividing said sheet material.

8. The method of making moldable mixtures which comprises coating fibrous sheet material with a solution of a phenolic condensation product, and drying and subdividing said sheet material.

In testimony whereof, I have hereunto subscribed my name this 28th day of Feb., 1919.

WILLARD H. KEMPTON.

Oct. 20, 1925. 1,557,730

F. S. SMITH

METHOD OF PRODUCING A FIBROUS MASS IMPREGNATED WITH A PHENOLIC CONDENSATION PRODUCT

Filed Feb. 15, 1921

Fig. 1.

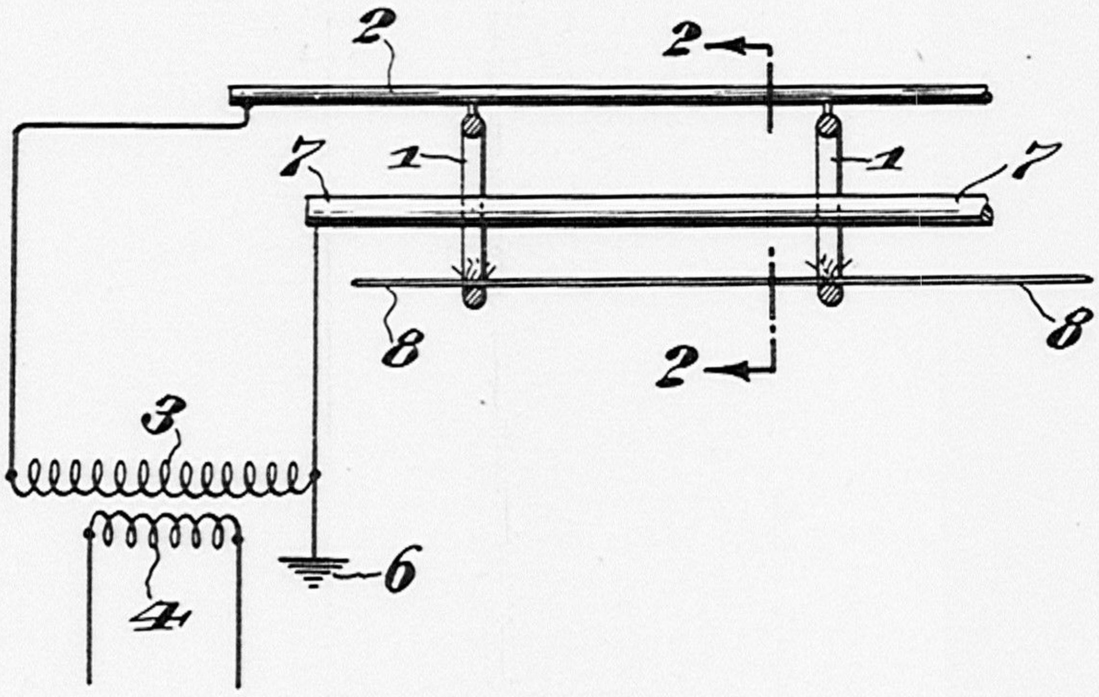
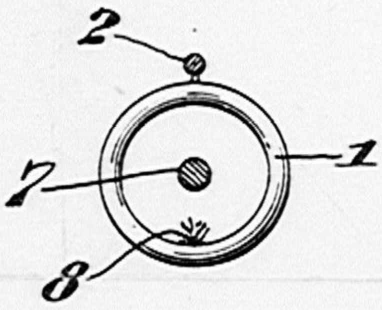


Fig. 2.



INVENTOR.

Franklin S. Smith

BY Cyrus N. Anderson

ATTORNEY.

Patented Oct. 20, 1925. **1,557,730**

UNITED STATES PATENT OFFICE.

FRANKLIN S. SMITH, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO THE PRODUCTS PROTECTION CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF DELAWARE.

METHOD OF PRODUCING A FIBROUS MASS IMPREGNATED WITH A PHENOLIC CONDENSATION PRODUCT.

Application filed February 15, 1921. Serial No. 445,114.

To all whom it may concern:

Be it known that I, Franklin S. Smith, a citizen of the United States, and a resident of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented an Improvement in the Method of Producing a Fibrous Mass Impregnated with a Phenolic Condensation Product, of which the following is a specification.

My invention relates to the method of producing material consisting of organic fibers such as jute, cotton, etc., impregnated with a phenolic condensation product, for instance, bakelite; the said product being either in the intermediate or B form, in which it is moldable, or in the final or C form.

One of the objects of my invention is to provide a novel method whereby an improved material consisting of organic uncut or natural fibers impregnated with an intermediate phenolic condensation product, as bakelite B, the said fibers so impregnated being moldable may be produced.

A still further object of the invention is to provide an improved and novel method whereby a material may be produced which in its final condition, in which the condensation product has been converted into the solid C form, possesses among other characteristics those of high tensile and dielectric strength (the latter being uniform in all directions), toughness and requisite homogeneity.

Another object of the invention is to provide a practical and workable method for the production of material of the character above mentioned.

Still another object of the invention is to provide a method whereby flexible uncut fibers, preferably organic, may be impregnated with a phenolic condensation product and molded into such form as may be desired.

No attempt will be made at this point to point out all of the objects and advantages of my invention, but other objects and advantages thereof will be pointed out in the detailed description thereof which follows or will be apparent from such description.

In the carrying out of my invention I take the spun fibers of jute (which I have found to be especially well adapted to the purposes of my invention), cotton or other like or equivalent materials, and impregnate them with an initial condensation product, such as bakelite A. One way of effecting this is to take the fibers in the form of yarn (by which term I include string, thread, cord, twine, etc.,) which has been wound into balls, and place the latter in a suitable receptacle containing an initial phenolic condensation product, as bakelite A, in solution in a mixture of ethyl or methyl alcohol and benzol in proportions which may range from thirty to seventy per cent. of alcohol by volume and from seventy to thirty per cent. of benzol to effect impregnation thereof. In practice the fiber balls of yarn are placed in a strong receptacle which is then hermetically sealed and the solution of bakelite A supplied to such receptacle under a pressure of approximately ten thousand pounds per square inch. The yarn is found to be fully or sufficiently impregnated within a period of a few minutes, five to ten, although the fiber balls of yarn may be allowed to remain in the solution for a longer period if desired. Such longer or additional treatment does not appear to have any beneficial effect; neither does it appear to have any deleterious or injurious effect. If the pressure is decreased the time required to effect complete impregnation is increased and by leaving the balls of fiber in the solution for a sufficient length of time, say a few days, impregnation may be effected at atmospheric pressure. The balls of yarn are then removed from the solution and the solvent removed therefrom. To effect rapid and efficient removal of the solvent not only from the surface but from the interior of the impregnated yarn or string it is then unwound from the said ball onto a reel, drum or the like, or a ball, and as it passes from the first named ball to the latter or to a reel or drum it is subjected to electric current of a voltage such as will produce a voltage gradient at the surface of the yarn or string sufficient to form corona thereon. The gradient necessary to form corona is 31.5 Kv./Cm. at standard temperature and barometric pressure. The first named ball from which the yarn is unwound is insulated and the yarn which is unwound therefrom is passed or moved in contact with an insulated metal terminal of suitable form having connection with one end of the secondary of a transformer the other end of which is grounded. Specifically, as illustrated in the drawing in which Fig. 1 is a view partly in section and partly in side elevation of a portion of apparatus which may be employed in the carrying out of the invention and Fig. 2 a transverse sectional view taken on the line 2—2 of Fig. 1, a plurality of metal rings 1 (of large diameter as compared with the yarn or string) are secured upon a metal bar 2 which is insulated and which is connected to one end of the secondary 2 of a transformer, the primary of which is shown at 4. The opposite side or end of the secondary is grounded, as indicated at 6, and is connected to a rod or wire 7 which extends through the said rings and is concentric therewith. The said rod or wire 7 is supported by any suitable support of insulating material, not shown. The yarn 8 is drawn through these rings in contact with any point thereof and corona is produced thereon as indicated by the divergent lines at 9. The charging of the yarn and the producing or forming of corona thereon causes the yarn or string to vibrate very rapidly and effects removal of the solvent therefrom. The yarn, before reaching the rings (or other form of contacts) is conducting, but after leaving the same is non-conducting, it having been freed of the solvents. The rings or other suitable contacts are spaced short distances from each other, and by varying the number thereof the speed at which the yarn can be unwound from the first named reel may be varied. By increasing the number so that the yarn is kept in contact with the contact members for a longer period as it travels along, the speed of movement thereof may be increased. While it is possible to convert the phenolic condensation product from the A to the B form by the action of the electric current such practice is not followed because of the time which would be required. In order, therefore, to convert the said product from the A to the B form the impregnated yarn, after the last mentioned step of the treatment, is heated to a temperature of from 75° to 80° centigrade, which effects conversion to the intermediate or B stage. A much higher temperature may be employed but its use requires much greater skill and experience.

The yarn or string thus treated and when cold is hard and wiry, but upon being heated to about eighty degrees centigrade and above becomes soft and pliable and may be molded into any shape desired.

In employing the material consisting of yarn of organic spun fiber impregnated with bakelite B for the manufacture of articles of whatever kind may be desired, and for which the said material may be suitable, an amount of the said yarn sufficient for the purpose in hand is packed into molds, previously heated. The mold is of a temperature above eighty degrees centigrade, preferably around one hundred and thirty degrees. The material when packed into the molds thus heated very quickly becomes soft and pliable, whereupon the plunger or die of a press into which the mold has previously been placed is moved down into the mold and the said material is subjected to pressure to form it into the shape of the mold which may be of the shape required for the purpose in hand. The pressure employed may range from one thousand to five thousand pounds per square inch. The pressure and the temperature are maintained for a period of time, depending upon the thickness of the article being molded or formed, during which the bakelite B is converted into bakelite C.

The impregnated yarn is packed indiscriminately that is, in a tangled or haphazard condition, into the mold so that one portion of yarn may be and is interlocked with another portion, the fibers thereof being thus interlocked and bound together.

The term "bakelite" employed in the specification and claims is used in a descriptive and not in a limiting sense and is intended to comprehend phenolic condensation products suitable for the purpose herein described and which possess or have the characteristics above indicated.

Having thus described my invention, what I claim and desire to secure by Letters Patent, is:

1. The method of producing a string of organic material impregnated with an intermediate phenolic condensation product which comprises, first, impregnating the same with an initial phenolic condensation product in solution and thereafter charging the same with an electric current of high tension and producing corona thereon.

2. The method of producing a string of organic material impregnated with bakelite B, which comprises first impregnating the same with bakelite A in solution, thereafter charging the same with an electric current of high tension and producing corona thereon, and simultaneously moving the string forward past and in contact with the charging means.

3. The method of producing a string of organic material impregnated with bakelite B, which comprises the dissolving of bakelite A in a suitable solvent, thereafter impregnating the said string with the solution thus formed, subjecting the same to the ac-

tion of a high tension electric current for removing the solvent from the said string and thereafter converting the bakelite from the A to the B form.

4. The method of producing a string of organic material impregnated with an intermediate phenolic condensation product, which comprises the dissolving of an initial phenolic condensation product in a suitable solvent, thereafter producing corona discharge upon the said string to remove the solvent therefrom and converting the initial to an intermediate phenolic condensation product.

5. The method of producing a solid fibrous mass of the character described, which comprises impregnating organic fiber with a solution of bakelite A, thereafter subjecting the said fiber to an electric charge of high tension and producing corona thereon to remove the solvent, thereafter applying heat to convert the bakelite A into bakelite B, and thereafter placing the said impregnated fiber in a mold and simultaneously subjecting it to pressure and heat at a temperature above eighty degrees centigrade.

6. The method of producing a solid fibrous mass of the character described comprising the impregnating of a string of organic fibers with bakelite A in solution, thereafter charging the said string with an electric current of high tension and producing corona thereon and simultaneously removing the solvent therefrom and also simultaneously moving the string forward, converting the bakelite A into bakelite B and thereafter packing the said string into a mold and subsequently simultaneously subjecting it to pressure and heat at a temperature above eighty degrees centigrade, substantially as described.

7. The method of producing a fibrous solid mass of the character described, comprising dissolving bakelite A in a mixture of alcohol and benzol, placing organic fiber string within the solution thus formed under pressure, thereafter removing the said string from the said solution and charging the same with an electric current of high tension to effect removal of the solvent, converting the bakelite A into bakelite B, the said string being thereafter packed into a mold and subsequently simultaneously subjected to the action of pressure and heat at a temperature above eighty degrees centigrade.

In testimony that I claim the foregoing as my invention, I have hereunto subscribed my name this 7th day of February, A. D. 1921.

FRANKLIN S. SMITH.

and standardized to such a degree that no composition containing essentially a natural or synthetic resin other than shellac has been able to make any great headway in phonograph record production. It is true that phenol-formaldehyde resins have been employed with success but only to a limited extent. The erosive action of the needle-point of the phonograph calls for an extremely tough binder and hardened rosin, rosin esters or the copals do not possess the toughness requisite to resist this erosive force. On the other hand, hardened rosin, rosin esters, congo and manila copal and cumaron resin may be employed in the production of knobs and other articles which do not require high mechanical strength. The harder varieties of resins obtained by the action of sulphur chloride on phenol described in Chapter 19 also may be used as binders. The brittleness of cumaron resin has been modified to some extent by the addition of a few per cent of linseed oil. Of course the oil reduces the softening point. In the field of synthetic resins those of the fusible type have not as yet displaced to any large extent the natural resins and mixtures of these with asphalts and asphaltites. The molding trade is still awaiting a cheap synthetic product having the hardness and toughness of shellac but possessing a somewhat higher softening point.

Fillers.

General.

The value of fillers in molding compositions depends upon several factors. In the first place, fillers are cheap while resinous binders in most cases are comparatively expensive, so it is advantageous to use as much and as cheap a filler as possible so long as the properties of the resulting composition are benefited. Resins when pressed into irregular shapes develop, on cooling and especially when a reaction has occurred, tremendous internal stresses due to shrinkage and these are relieved only by the formation of cracks throughout the piece. Fillers play an important part in minimizing shrinkage and in reducing the stresses to a large extent. The improvement of other properties depends upon the nature of the binder, and the kind, quality and quantity of filler or fillers employed. For example, mica, in conjunction with other mineral fillers such as gypsum, is satisfactorily used with shellac or phenol sulphur chloride resins, but mica may not be employed so advantageously with phenol-formaldehyde resins, because the latter do not "wet" or cover the particles, and the strength expected of this type of resin in the infusible form does not obtain. Due to the density of mica and gypsum the percentage of these fillers may often reach 70 to 90 per cent of the composition with a proportional increase in density of the molded article. The use of 70 per cent mineral filler with shellac yields a mechanically strong composition due to the inherent toughness and strength of shellac. Rosin with the same kind and proportion of filler would be very weak. A composition from rosin and 50 to 60 per cent wood flour, while undoubtedly a poor product from the standpoint of heat resistance, odor, etc., would undoubtedly be considerably stronger mechanically. Thus the choice of fillers depends mainly upon the properties desired of the finished product and the nature of the binder.

Fibrous Fillers.

Wood Flour.

Wood flour or cellulose fibre is perhaps the most universally used of all fillers in molding compositions of the infusible type. The reason is that wood flour, although fairly bulky, is usually advantageous because the resin not only coats but impregnates the fibres, thereby giving additional strength and homogeneity to the molded product. Molded articles prepared from this material are relatively light in weight and possess a high dielectric strength. This filler is made in many grades and is sometimes difficult to secure of a suitable quality for molding compositions.

One of the principal objections to wood flour filler is its voluminous character. The majority of wood flours are too bulky and it is important to choose a grade which is low in bulk. A crude but simple method of testing is to take, say, 20 grams of the sample, place it in a graduated cylinder and tap it on a table until the volume remains constant. The bulk should be less than 80 cc. and preferably about 65 cc. or less. The bulk expressed as $\frac{\text{cubic centimeters}}{\text{grams}} = \frac{65}{20} = 3.25.$

Upon examination under a microscope the cellulose fibres should appear to be fairly uniform in size and free from particles of foreign matter.

About 80 per cent of the wood flour used for molding compositions should pass an 80 mesh screen. The moisture content as determined by loss in weight on heating at 105° C. for 24 hours preferably should not be over 5 or 6 per cent. The wood flour should not contain metallic or abrasive matter which would injure the mold. The color is not always important; although for light colored products or when no coloring matter is employed in the composition this factor enters into the choice of the filler.

Asbestos.

Asbestos as a filler, although yielding a product fairly low in tensile strength, is resistant to shock due to the long fibres which it is possible to employ and at the same time the product withstands a higher temperature without carbonizing than would be the case if wood flour were employed. Asbestos fibre being impermeable cannot be impregnated with the resin and the coating obtained is insufficient to produce a molded product having as good an appearance as one derived by the use of wood flour. Asbestos filled compositions have many limitations in molding. The asbestos mixtures will not flow as wood flour compositions will. The uncoated fibres stick to the mold and the products have not the same smooth surface which wood flour products exhibit.

Asbestos is marketed in many grades and forms. It possesses little or no tensile strength but is flexible and silky and can be obtained perfectly white. It is used as a powder or "flour" and also in long-fibred form. Articles having a good appearance can be prepared using asbestos flour but these are weaker mechanically than when the longer fibres are employed.

Cotton Flock and Cotton Linters.

Cotton flock and linters are used in proportions ranging from 2 to 5 per cent of the entire mix to enhance the shock-resisting properties of compositions not requiring extreme resistance to heat. They are very commonly used in fusible compositions in conjunction with fillers such as mica and gypsum. Cotton flock may be obtained in fibres of varying length. It has a great tendency to form small balls or pellets when baled for shipment and should therefore be bolted before mixing.

Silk Flock.

Silk flock has been used in the manufacture of billiard balls and for other purposes where mineral fillers are used in articles requiring machining. Cotton flock compositions when machined do not produce a surface which will polish well and silk flock has been found much superior in this respect.

Paper and Canvas.

Paper and canvas are used extensively in the manufacture of laminated pressboard. Products obtained by the use of these have been described in Part 1, and while paper and canvas are not suitable for use in molding compositions, large quantities are employed in pressboard for electrical insulation and for the manufacture of noiseless gears.

Powdered Fillers.

Of the host of powdered fillers very few are used to give strength to molding compositions but are primarily employed for increasing the hardness of surface, reducing shrinkage and cheapening the product. Mica, however, when used in conjunction with other fillers, or by itself, adds considerably to the mechanical and dielectric strength of the product. Powdered fillers such as china clay, rottenstone, gypsum, silex and flint are used in the manufacture of sound record compositions. Such fillers form a hard foundation or bed for the phonograph needle to traverse. Most of these powdered mineral fillers add considerably to the density of the molded product which is in some cases a decided disadvantage. However their usage makes possible the reduction in the amount of binder in the composition and whereas about 50 per cent of binder is customary with a wood flour filler a proportion of 20 per cent is often used with powdered mineral fillers such as mica, gypsum, etc.

Coloring Agents.

Both dyes and pigments are employed for coloring molding compositions; the dyes being preferable in molded products used for electrical insulation. On the other hand if the product is to be used for purposes requiring high heat resistance pigments are often more satisfactory and retain their color better. Aniline dyes are frequently employed in these compositions and pigments such as bone black and iron oxide are used to a large extent. Manganese dioxide or pyrolusite may be used as a dark brown or black filler.

Lubricants and Plasticity Agents.

Since resinous molding compositions sometimes show a tendency to stick to the steel dies it is desirable to employ a lubricant of some kind in the composition. Oils and waxes have been employed for this purpose. Due to the fact that little is known of the cause of sticking to molds the proper lubricant can be determined only by trial. Plasticizing agents or fluxes often are required especially in sheeted forms of compositions, to render the resin plastic at a comparatively low temperature. This condition is necessary to permit shaping and packing in the mold prior to pressing. The plasticizing agent or flux should be a solvent for the resin and in the case of infusible compositions the flux either must undergo reaction to an infusible state or remain in (solid) solution in the composition; otherwise a spotted surface will result.

167 [Stamp:] Mailed Mar. 11, 1932.

Department of Commerce, United States Patent Office.

Before the Board of Appeals on Appeal.

In re Application of Oscar A. Cherry et al. Serial No. 334,132. Filed Jan. 21, 1929. For Moldable Composition of Matter and Process for Producing Same.

Examiner's Statement.

This is an appeal from the final rejection of Claims 8 to 13, appearing in Paper #5, to which attention is respectfully directed.

The references relied on are:

Miller, 1,061,770, May 13, 1913,
Talley, 1,223,216, Apr. 17, 1917,
Kempton, 1,513,323, Oct. 28, 1924,
Smith, 1,557,730, Oct. 20, 1925.

The claims relate to a moldable composition using a thermoplastic heat hardenable artificial resin as the binder. With such resins there is ordinarily used an approximately equal quantity of filler. The filler may be a powdered mineral substance such as clay, slate talc etc. or it may be a fibrous filler, the usual examples of which are cotton flock, wood meal, or asbestos fibre. The particular distinction here is said to reside in the use of "relatively short lengths of spun fibrous material in stringlike form". The description refers to the use of yarn such as four ply cotton yarn. The pieces may be as short as an eighth of an inch, or as long as one half inch. It is said that pieces over an inch and a half may be used, but that the plasticity decreases rapidly for increases in length above the last mentioned value. The advantage in the use of pieces of yarn in place of ordinary fibre is said to be in a greatly increased strength of the resultant molded article, particularly the impact strength. It is said that all materials of a "stringlike nature"
168 give the advantage. It is indicated that pieces of a half inch length yield stronger articles than those of an eighth inch in length. The resin is incorporated with this filler by impregnating or coating the twine with the resin and then cutting the twine into short lengths.

The desirability of strong, long fibrous elements in molded products is well recognized.

Miller produces a gear wheel by compressing textile fibres between two plates. Apparently, no binder is used.

Kempton was working on the same problem as the present applicants are concerned with. He impregnated canvas with a resin and then shredded the canvas to provide long cotton fibres which he states gave a much stronger product when molded than was obtainable by the use of conventional fillers.

Talley was also concerned with the same problem. He uses fibrous materials having long fibers. This material is impregnated with a resin and after drying molded.

Smith is likewise concerned with the same problem. Yarn in balls or on spools is impregnated with a resin and then dried. The yarn is placed in the mold in a tangled mass and molded in the usual manner with heat and pressure.

It will be evident that the sole issue of the case is the question of the merit of the use of "relatively short lengths of spun fibrous material in stringlike form". The expression is indefinite as to the length. It seems to be intended to include pieces as short as an eighth of an inch and also lengths greater than one and one-half inches. No great difference is seen between yarn cut in lengths of an eighth inch and Kempton's shredded fabric, particularly if it be duck (page 2, line 5). Talley states that the *mass* is loose and fluffy while applicants state that their individual pieces are "string-like". That is a matter depending on the
169 character of the yarn and on the degree of impregnation, and of course on the point of view.

On the other hand it is considered that pieces greater than an inch and a half in length would form a tangled mass in a mold which would be exactly the equivalent of Smith's tangled mass. There is nothing in Smith to indicate that he is to be confined to the use of one continuous piece for each filling of the mold. No essential difference is seen between a sufficient number of pieces over one and one-half inches in length to fill a small mold, and one or two pieces in a tangled mass for the same purpose. It thus appears that the shortest pieces here specified are fairly equivalent of Kempton and the longest are fairly equivalent of Smith. It further appears that the expression used to define the lengths is indefinite. Claim 10 does define the maximum length as two inches. There is nothing in the case to indicate that this length is critical. The last few lines of page 5 would indicate that such length would not be as plastic as desired.

An affidavit was filed by one of the applicants. It states that wood flour molded articles using wood flour as a filler are the weakest with macerated fabric, (character not stated) are next, and the continuous string filler next. The last mentioned and pieces of one and a half inches yield articles of about the same strength. The claims are not limited to one and one-half inch lengths of string. Nothing in the affidavit shows any real difference over Smith, nor is there any indication that pieces of string as short as one-eighth inch are different from Kempton's shredded canvas.

C. L. BLAKE,
Examiner, Division 50.

IX/K.

170 [Stamp:] Mailed Jul. 28, 1932.

Department of Commerce, United States Patent Office.

Before the Board of Appeals on Appeal.

In re Application of Oscar A. Cherry et al. Serial No. 334,132. Filed Jan. 21, 1929. For Moldable Composition of Matter and Process for Producing Same.

Examiner's Supplemental Statement.

The case has been remanded to the Examiner under the provisions of Rule 138, for consideration and report on the affidavit filed.

The issue of the case is as to the patentable merit of the use of "relatively short lengths of spun fibrous material in stringlike form" as a reinforcing filler for a plastic composition in place of Talley's long fibers, Kempton's shredded canvas or Smith's long pieces of string. The Examiner held that the characterization of the length in the claims was indefinite and differed in degree only from and was intermediate between those of the references, and further that the shortest lengths suggested by the description were not different from Kempton and that the longest did not give different results from Smith.

The facts given in the affidavit support the Examiner's conclusion. The tests presuppose an arrangement of the fibrous elements in the test bar so as to al*l*ign them, though no data is given as to the size of the bar or the method of distributing the fibres. There is nothing in the case or

in the claims as to any method of distributing the fibres in the mold. As will be evident from a consideration of the mechanics involved, the average shearing strength should be about the same for long and short fibres, with accidental distribution, until very short fibres are used. If the fibres are alligned the advantage is with fibres sufficiently long so that the ends will be firmly held in the matrix of binder. This is evidenced by the shear tests (a) and (b), the second shear test cutting in two directions. The modulus of elasticity is of course greater with longer lengths also, up to dimensions near the length of
171 the tested portion.

As was said above, the affidavit does not give any data as to the allignment of the string, nor are the claims limited in this respect. The tensile and transverse strengths apparently indicate that with the longer lengths the fibrous elements were alligned a great deal more in a crosswise direction than in a lengthwise direction, so that the tensile test pulled the fibres apart, whereas the transverse (presumably tensile) test showed the advantage of length. Of course such tests could not be duplicated unless the method of inserting the fibrous mass in the mold was specified.

The illustrations and argument concerning the gear teeth have no pertinency to the claims in controversy.

The conclusions 1 to 4 have no relation to the claims in question but relate to the practicability (not operativeness) of a process of molding gears from the materials of the Smith patent as compared to the present material. It is to be noted that the article claims here would be squarely readable on the result of molding a gear blank and then cutting the teeth from Smith's material (see conclusion 2).

The Examiner is therefore of the opinion that the pertinent portion of the affidavit merely supports the rejection on the ground that the claims differ from the prior art in a matter of degree only and that this difference is indefinitely stated in Claims 8 to 11 and 13 and too broadly stated in Claim 12 to support applicants' contentions.

Respectfully submitted,

C. L. BLAKE,
Examiner, Division 50.

IX/K.

172 [Stamp:] U. S. Patent Office, Board of Appeals. Mailed Oct. 17, 1932.

Appeal No. 4851. Paper No. 17.

Decision.

Hearing: Sept. 22, 1932. MCV.

In the United States Patent Office.

Before the Board of Appeals.

Ex parte Oscar A. Cherry and Franz Kurath.

Application for Patent filed Jan. 21, 1929, Serial No. 334,132. Moldable Composition of Matter and Process for Producing Same.

Messrs. Wilkinson, Huxley, Byron & Knight for applicants.

This is an appeal from the final rejection of the six claims in the case numbered 8 to 13, inclusive.

Claim 8 is illustrative and reads as follows:

> 8. A thermoplastic molding composition comprising a thermoplastic reactive resinous binder and a filler consisting of relatively short lengths of spun fibrous material in string-like form.

The references relied upon are:

Miller, 1,061,770, May 13, 1913,
Talley, 1,223,216, April 17, 1917,
Kempton, 1,513,323, Oct. 28, 1924,
Smith, 1,557,730, Oct. 20, 1925.

The alleged invention relates to a moldable composition of matter and process for producing the same. Its nature is clearly set forth in the examiner's statement as follows:

> The claims relate to a moldable composition using a thermoplastic heat hardenable artificial resin as the binder. With such resins there is ordinarily used an approximately equal quantity of filler. The filler may be a powdered mineral substance such as clay, slate talc etc. or it may
> 173 be a fibrous filler, the usual examples of which are cotton flock, wood meal or asbestos fibre. The par-

ticular distinction here is said to reside in the use of "relatively short lengths of spun fibrous material in stringlike form." The description refers to the use of yarn such as four ply cotton yarn. The pieces may be as short as an eighth of an inch, or as long as one half inch. It is said that pieces over an inch and a half may be used, but that the plasticity decreases rapidly for increases in length above the last mentioned value. The advantage in the use of pieces of yarn in place of ordinary fibre is said to be in a greatly increased strength of the resultant molded article, particularly the impact strength. It is said that all materials of a "stringlike nature" give the advantage. It is indicated that pieces of a half inch length yield stronger articles than those of an eighth inch in length. The resin is incorporated with this filler by impregnating or coating the twine with the resin and then cutting the twine into short lengths.

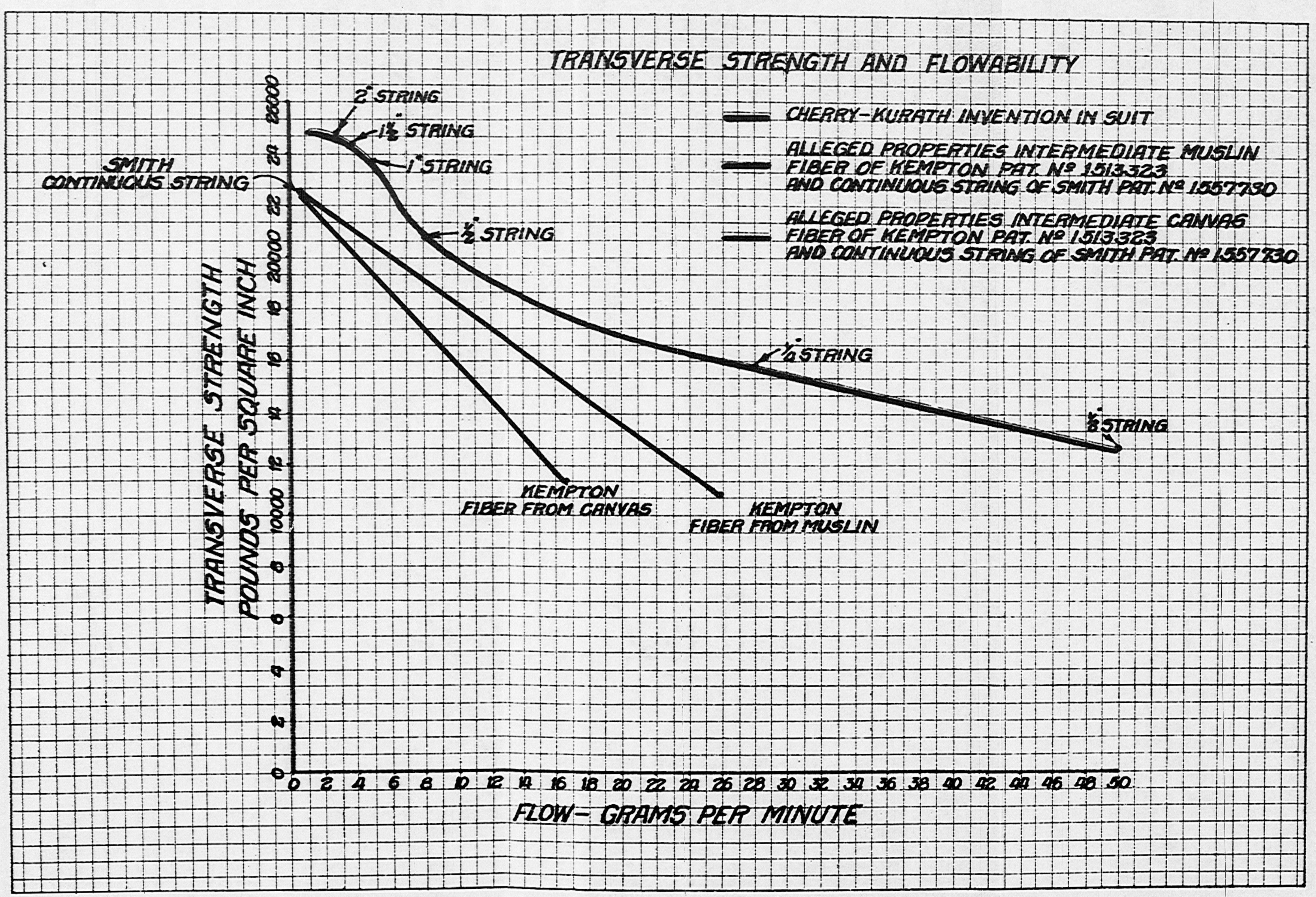
The examiner points out that Kempton was working on the same problem as appellants and impregnated canvas with a resin, then shredded the canvas to provide long cotton fibres, thereby obtaining a moldable composition alleged to produce a much stronger product due to the long cotton fibres. Kempton's specification states that he dries the product impregnated with a phenolic condensation product in liquid form, and then comminutes the sheet material to provide a fluffy mass of moldable composition, and that this comminution may be obtained by grinding the fabric, shredding it or chopping it up.

The patent to Talley relates to the same problem and uses fibrous material having long fibres.

Smith attempted to solve the problem by impregnating balls or spools of yarn with a resin under pressure and then placing the yarn in a tangled mass in the mold.

Appellants state that they preferably use short lengths of spun fibrous material in string-like form, ranging in length from one eighth of an inch to one inch and a half. The patents to Smith and Kempton apparently use the same or similar material. The contention of appellant that
in Kempton the material is too short and not string-
174 like and that the string used by Smith is too long to
effect the best results or anticipate the claims, is believed to relate merely to an unpatentable matter of degree.

PLAINTIFF'S EXHIBIT NO. 6



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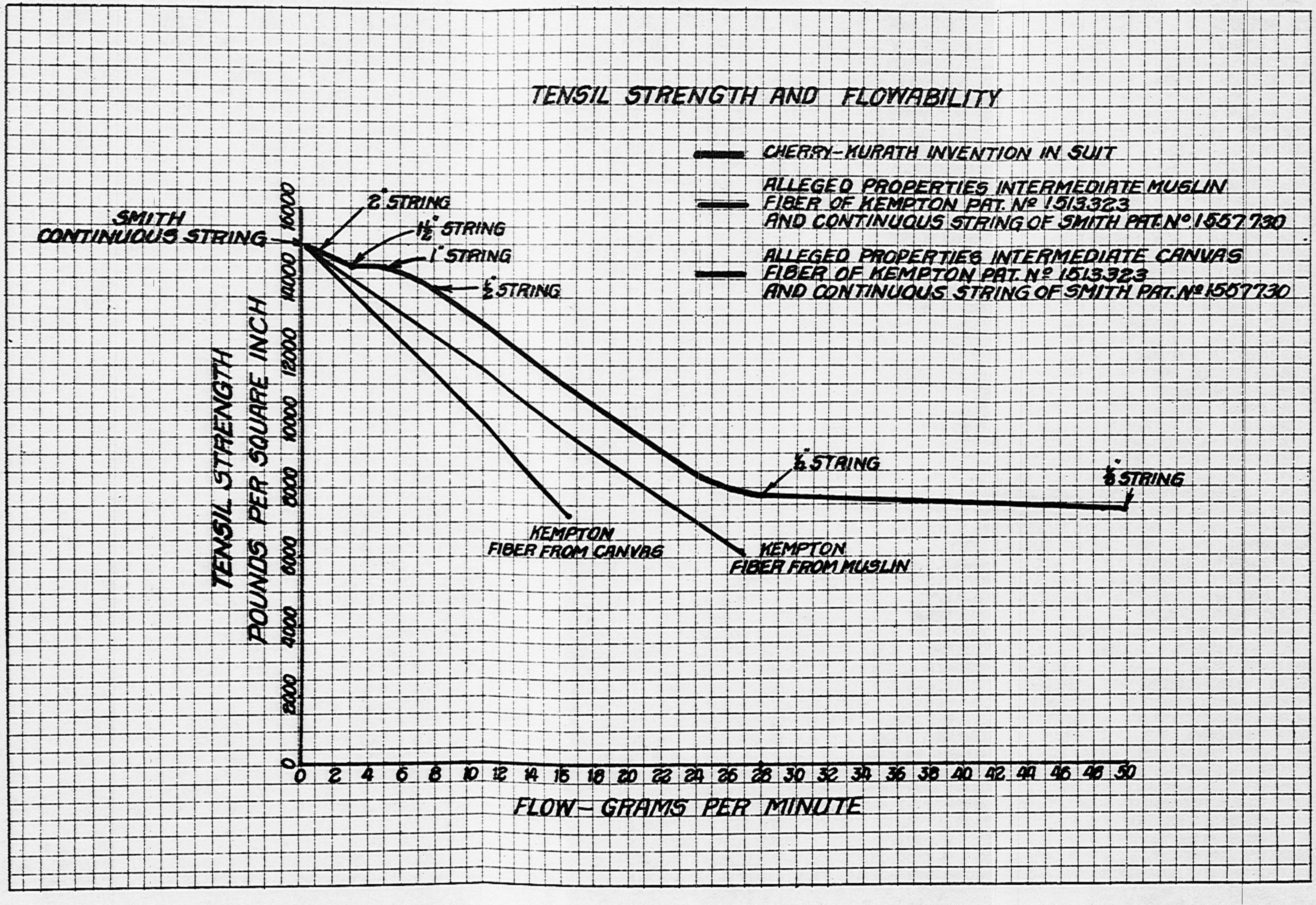
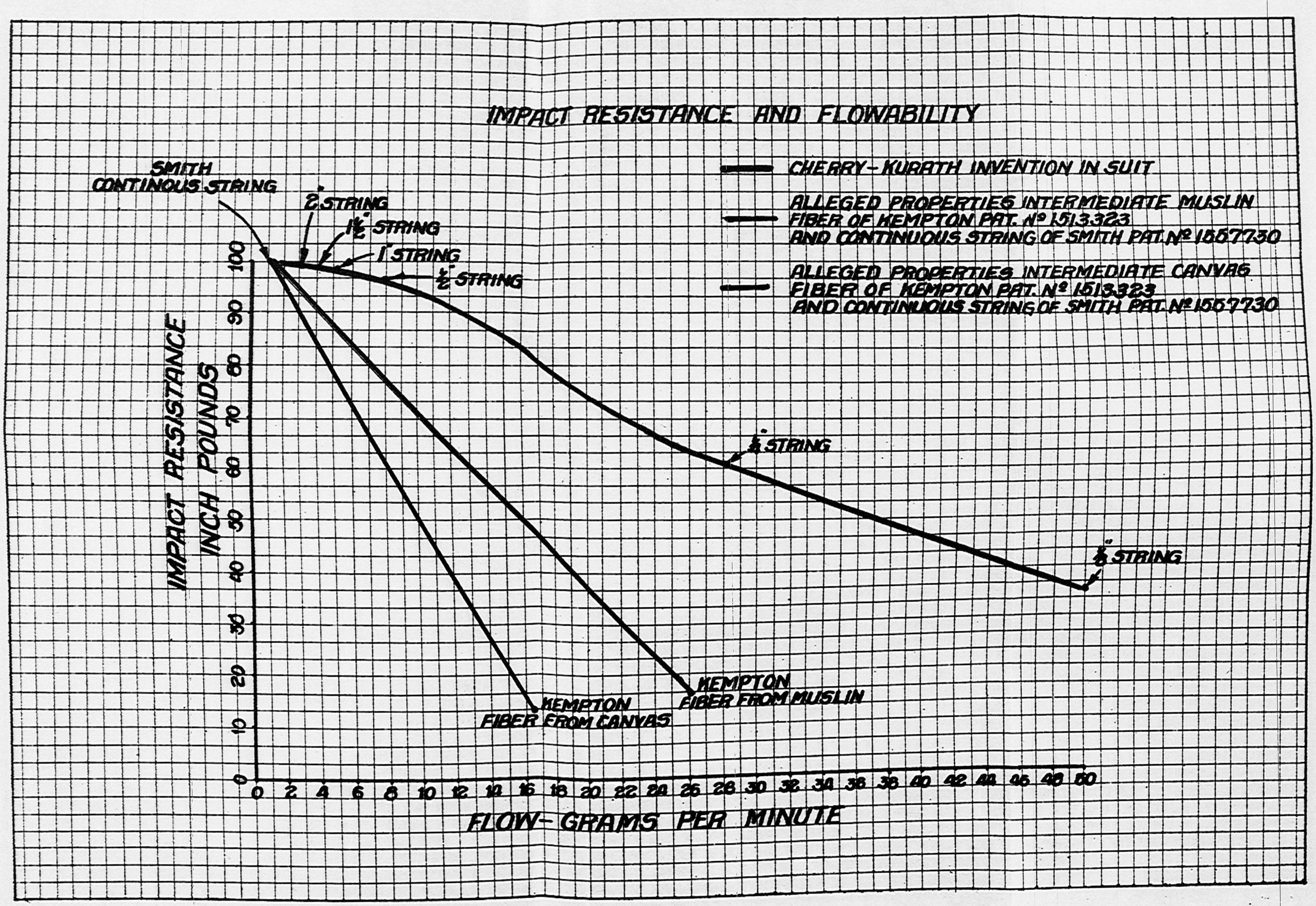
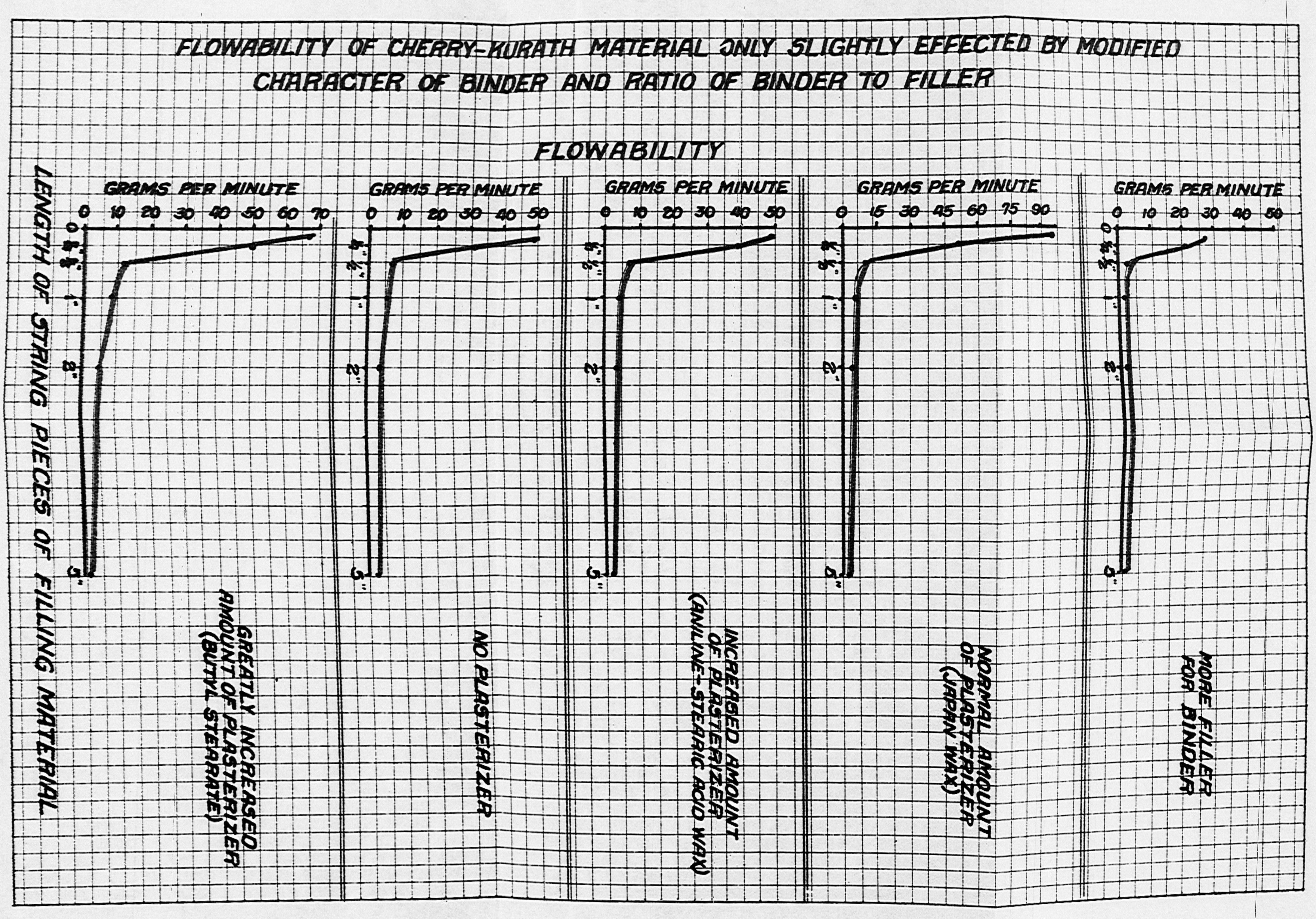


PLAINTIFF'S EXHIBIT NO. 7

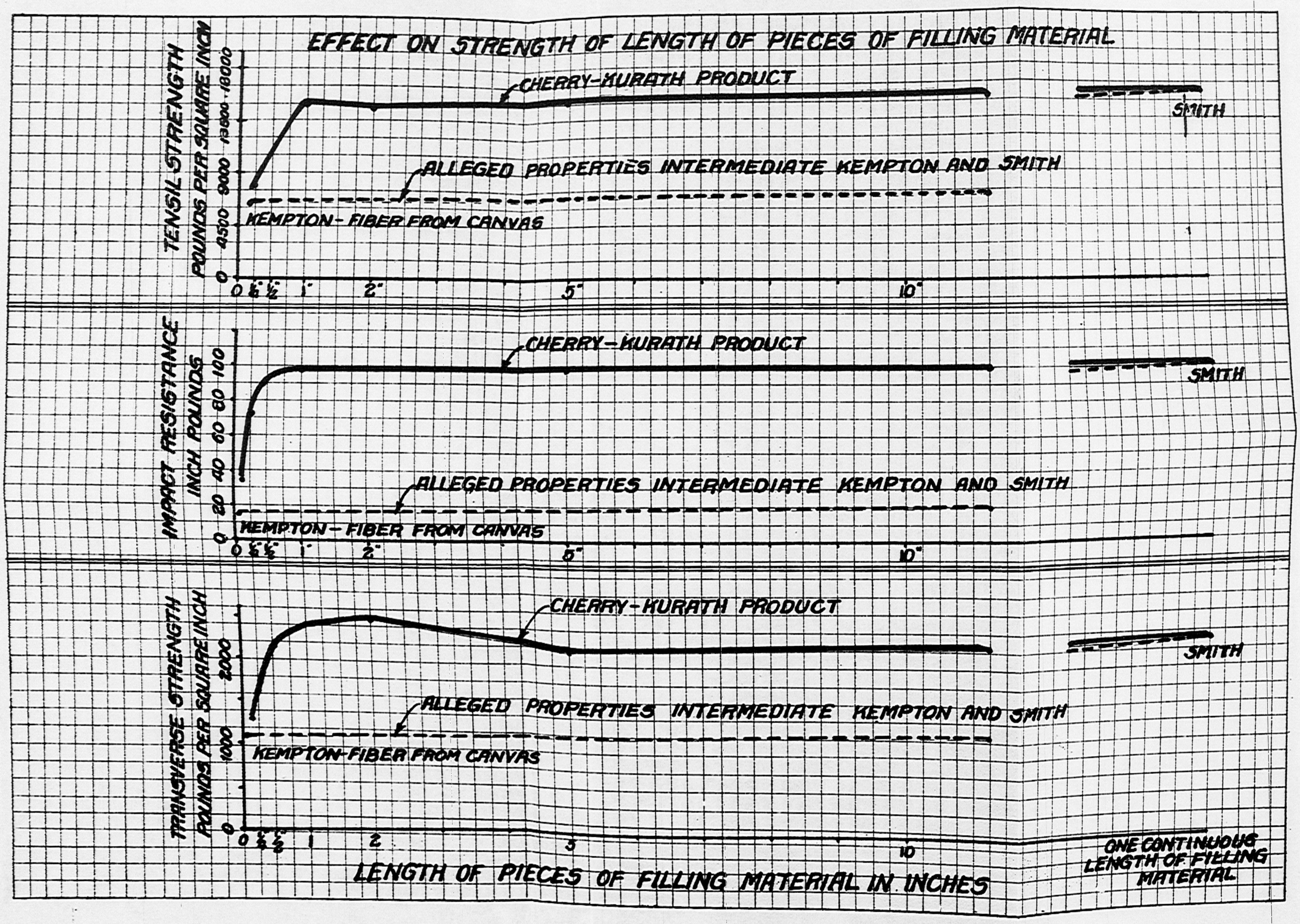


PLAINTIFF'S EXHIBIT NO. 8



FLOWABILITY OF CHERRY-KURATH MATERIAL ONLY SLIGHTLY EFFECTED BY MODIFIED CHARACTER OF BINDER AND RATIO OF BINDER TO FILLER

PLAINTIFF'S EXHIBIT NO. 9



FOR MR. JUSTICE ROBB

UNITED STATES
COURT OF APPEALS FOR THE
DISTRICT OF COLUMBIA

FILED OCT 31 1935

Henry W. Hodges

IN THE

United States Court of Appeals for the District of Columbia

ECONOMY FUSE AND MANUFACTURING COMPANY,
Appellant,
vs.
CONWAY P. COE, COMMISSIONER OF PATENTS,
Appellee.

No. 6510.

BRIEF ON BEHALF OF APPELLANT.

E. W. SHEPARD,
Solicitor for Appellant.

JAMES P. HUME,
HENRY M. HUXLEY,
Of Counsel.

THE GUNTHORP-WARREN PRINTING COMPANY, 210 WEST JACKSON, CHICAGO

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IN THE

United States Court of Appeals for the District of Columbia

ECONOMY FUSE AND MANUFACTURING COMPANY, *Appellant,* *vs.* **CONWAY P. COE, COMMISSIONER OF PATENTS,** *Appellee.*	No. 6510.

BRIEF ON BEHALF OF APPELLANT.

This is an appeal from the decision of the Supreme Court of the District of Columbia which held adversely to the plaintiff-appellant in a suit under Section 4915 of the Revised Statutes.

Statement of the Case.

The subject matter of this suit involves the right of appellant to obtain a patent for an invention disclosed and claimed in an application filed by O. A. Cherry and Franz Kurath, for Moldable Composition of Matter and Process for Producing Same, Patent Office Serial No. 334,132, filed January 21, 1929. A patent on said application was finally refused by the Commissioner of Patents. (Rec. pp. 126-128, Incl.) It has been admitted by the appellee that the entire right, title and interest in and to the invention of said application is now vested in the appellant, Economy Fuse & Manufacturing Company. (Rec. p. 8.)

ERRORS RELIED UPON.

Appellant relies upon each of the errors recited in the Assignment of Errors, (Rec. pp. 11, 12, and 13) but appellant's position may be summed up in the statements of error reading:

> 15. The Court erred in paragraph 1 of the conclusions of law in holding that the plaintiff's claims are unpatentable over the prior art adduced by defendant.
>
> 16. The Court erred in paragraph 2, of the conclusions of law in holding that the selection of relatively short lengths of spun fibrous material is but a change of form of the fibers, woven fabric and tangled yarn of the prior art, the selection of which would be obvious to one skilled in the art.
>
> 17. The Court erred in paragraph 2, of the conclusions of law in failing to hold that the present invention is productive of new and unexpected results which are not taught or suggested in the prior art patents considered individually or collectively, and which constitutes a patentable invention.

SUBJECT MATTER OF THE INVENTION IN SUIT.

The invention in suit relates to a thermoplastic molding composition. It also relates to a process of molding employing such composition, and to the finished molded articles produced from such molding composition.

When issuance of the patent was refused by the Commissioner of Patents, the application contained six claims as follows:

> 8. A thermoplastic molding composition comprising a thermoplastic reactive resinous binder and a filler consisting of relatively short lengths of spun fibrous material in string-like form.

9. A thermoplastic molding composition comprising a thermoplastic reactive resinous binder and a filler coated with the binder consisting of relatively short lengths of spun fibrous material in string-like form.

10. A thermoplastic molding composition of substantially uniform quality and having a high degree of flowability into irregular molded shapes comprising a thermoplastic reactive resinous binder and a filler coated with the binder consisting of pieces of spun fibrous material in string-like form of a length less than two inches.

11. The process of molding which consists in coating a continuous length of spun fibrous string material with a solution of a thermoplastic reactive resin, drying the coated string, cutting the coated string into relatively short lengths and molding an intermingled mass of the short lengths of string under conditions of heat and pressure in such a manner that the mass flows to an appreciable extent during molding.

12. The process of molding which consists in coating a continuous length of spun fibrous string material with a solution of a thermoplastic reactive resin, drying the coated string, cutting the coated string into pieces of length less than two inches and causing an intermingled mass of the coated pieces of string to flow under conditions of heat and pressure in a mold.

13. A molded article of manufacture of irregular shape and uniform quality having a high tensile strength and high resistance to fracture by impact comprising an insoluble and infusible resin and a filler of relatively short lengths of spun fibrous string-like material formed *in situ*.

The molding composition here referred to is a material consisting essentially of two ingredients, namely, a binder and a filling material. In the form in which it is ready for molding it is a dry material which is softened when exposed to heat and becomes thermoplastic and moldable. This material is adapted to be placed in a mold of desired shape and pressed under relatively heavy pressure and heated to relatively high temperatures by the walls of the mold, so as to form various objects and articles of commerce.

Molding compositions of this general type are well known and there are many such compositions now employed in various industrial uses for making numerous objects. Such compositions have resulted from the development of certain synthetic resinous materials which are suitable for use as the binders thereof.

These resinous materials are produced by reacting various chemical ingredients in accordance with very complex chemical reactions and whereas an understanding of the chemistry is not essential to the determination of this case, it should be known that the reactions are progressive in character or are such that they gradually and progressively convert the initial reactants into the final, hard and resistant resinous product.

Due to the progressive character of the reaction, the chemical formation of the resin may be arrested at an intermediate point at which the intermediate product, though somewhat similar to the final product in appearance, is thermoplastic and capable of being dissolved in various solvents. Thus such intermediate products are capable of being handled and worked with, by softening under heat or by dissolving in solvents, in a manner convenient to form finished objects. Such intermediate products are often referred to as "thermoplastic and potentially reactive".

The binder contemplated for use as an ingredient of the molding composition of this invention is any one of the resins of the group above referred to, which are thermoplastic as well as potentially reactive. Being thermoplastic the resin is subject to being softened by the heat of the molding operation so as to become flowable in the mold and thus caused to take the shape of the mold. Being potentially reactive, the resin undergoes a final chemical change under the influence of the heat of the molding operation whereby when the final molded objects are produced, they possess great permanence and durability and are no longer thermoplastic nor capable of being dissolved in solvents.

The other essential ingredient of the molding composition of this invention is a filling material. Filling materials are employed to give greater strength to the resinous binder. The particular filling material here employed is composed of relatively short lengths (approximately 1/8th of an inch to 2 inches in length) of strong pieces of string, or as defined in said application, "relatively short lengths of spun fibrous material in string-like form."

The novelty of this invention resides in the combination of a binder composed of a thermoplastic, reactive resinous material of the type above described and a filling material of relatively short pieces of string. This combination is entirely novel. Even though it includes known resinous binders the employment of relatively short pieces of string as a filling material is entirely new and in combination with the binder is not only novel but is productive of new and improved results, nowhere disclosed in the prior art cited in this record.

RESULTS ACCOMPLISHED BY THIS INVENTION.

The molding composition of this invention, when molded under heat and pressure is capable of flowing in the mold so as to form objects of irregular shape which, when completed, are as strong as machined steel. (Rec. p. 26.) Such extraordinarily high strength renders this material usable for the production of various machine elements, such as levers, gears and many other heavy duty machine parts.

This invention provides the first molding composition which is both moldable and productive of that high degree of strength required for machine parts.

PRIOR DEVELOPMENT OF THE ART.

A brief understanding of the development of this art will greatly assist in determining the issues here presented.

This type of molding composition has come into existence since the advent of synthetic resins which as above pointed out, have been used as binders for molding compositions of this type. Synthetic resins were originally produced in an effort to provide artificial substitutes for the commercially important natural resins. Thus chemical substances possessing the properties of natural resins were sought. In this development, various substances have been discovered and applied commercially which have possessed, to a satisfactory degree, those properties which characterized the natural resins as commercially valuable and yet which in addition, possessed many new and superior properties. The progressive character of the reaction and the ultimate conversion of the resin into an insoluble, infusible state is one of the important new properties of the potentially reactive synthetic resins. No natural resin is known to have the high degree of permanence and durability possessed by synthetic resins in their final stage of conversion.

Commercial development of the artificial resin industry led to the application of such resins to various industrial fields, as substitutes for natural resins and to new uses flowing from their new properties. For instance, such resins have been dissolved in solvents and used as varnishes and the like. They have also been cast in suitable molds to form various objects such as cigarette holders and other similar articles which are useful in commerce but which do not require much strength or the elimination of the brittle character of the resin, for their successful use. Furthermore, molding compositions were developed, employing filling materials in conjunction with the resinous binders. Filling materials were found to add strength to the finished products, and give body to the composition during molding. Usually the filling material was soaked with a solution of the resin and then dried. The filling material thus impregnated would constitute the molding composition which, when subjected to the heat and pressure of the molding operation would soften and form the finished objects.

Molding compositions are somewhat stronger than cast resinous products which have no filler. They are also capable of being molded to form objects of irregular shape. In other words, they can be made to actually flow in the mold so that there is a movement of the plastic material to all portions of the interior of the mold, no matter how remote, in such manner as to fill out and completely form irregularly shaped objects.

As flowability in the mold is essential to the moldability of irregularly shaped objects, molding compositions of this type, prior to this invention, have always employed finely divided filling materials. It was considered that any bulky, solid materials used as fillers, would interfere with the thermoplastic character of the composition as a whole and would thus impair its flowability and consequent moldability.

The most popular filling material for such molding compositions has been wood flour, (very fine sawdust) but other finely divided fillers have also been used, such as fibers of cotton, linen or other lint. Also asbestos and like fibers were used. In all cases however such fibers have been the raw unspun fibers. Only finely divided fillers were employed as such were believed to be essential to the flowability of the composition. In no case were fillers employed which would produce strengths even approaching the strength required for heavy duty machine parts.

Where greater strength was desired, moldability was sacrificed. Whereas heavy duty machine parts heretofore have been made from resinous materials, they were not made from molding compositions nor by molding operations. Rather they were made by machine cutting operations by which the desired parts were shaped and fashioned from a board of block-like blank of resinous material, in much the same manner employed for cutting objects from blanks of steel, wood or other solid materials. This class of resinous products are generally referred to as "laminated" products and the blanks therefor are made by saturating sheets of cloth or paper or other material, with a solution of resin and subsequently drying the same. Upon being dried, the sheets are next superimposed to build up a laminated board-like piece or a thick block. Such laminated pieces or blocks are next pressed under severe pressure and heat. Such laminated sheets obviously cannot and do not flow but are merely compressed and heated which compacts them and causes the resin therein to flow and bind the laminations into a unitary board-like blank or block. Such blank pieces are then cut by machining operations in a manner analogous to that of cutting steel, wood or any other raw material, so as to form whatever finished objects may be desired.

These laminated products possess great strength and like the objects produced from the composition of this invention, are as strong as machined steel. However, it is evident that such strength is acquired at the sacrifice of moldability and that such products are derived only as a result of expensive machine cutting operations. It is further apparent that the machine cut surfaces of any objects so formed have raw edges of the fabric or paper layers exposed, which is detrimental to the product due to the tendency to wear at the location of such exposed edges and the tendency of the exposed fibers to absorb oil, moisture and like absorbable fluids.

With the prior art developed to the extent here indicated this invention was made to provide a composition which is both moldable by ordinary commercial practices to form irregularly shaped objects and productive of objects stronger than laminated products and many times stronger than the molded products of the prior art. Thus, this invention provides for the first time, a composition which may be molded and thus caused to flow in the mold to form irregularly shaped objects which are so strong as to be suitable for use as heavy duty machine parts.

PRIOR DISCLOSURES RELIED UPON BY THE COMMISSIONER OF PATENTS.

In refusing a patent on this invention the Commissioner of Patents cited the following Letters Patent of the United States:

Miller	1,061,770	May 13, 1913
Talley	1,223,216	April 17, 1917
Kempton	1,513,323	Oct. 28, 1924
Smith	1,557,730	Oct. 20, 1925

As far as appellant can determine the patent to Miller was not relied on. Miller was cited but it was not specifically referred to nor in any way represented as pertinent to the patentability of this invention.

The disclosures in the Talley and Kempton patents may be regarded as being the same. (Rec. p. 22.) In so far as the Commissioner of Patents has contended that they bear upon the issues here involved, their disclosures are the same. Both show moldable compositions having finely divided fabric fillers of substantially the same type and they differ one from the other only in that Kempton discloses what he regards as an improved method of securing a more thorough impregnation of the fibrous filling material.

Although the above four patents are the only prior art disclosures relied upon by the Commissioner of Patents in refusing a patent, the defendant has also cited in the answer to this suit an article on "Fillers", pages 378-380, in the publication entitled "Synthetic Resins and Their Plastics", by Carlton Ellis, published by the Chemical Catalog Company, Inc., 19 E. 24th St., New York, N. Y. (Rec. pp. 119-121, incl.)

Re: Miller Patent No. 1,061,770. (Rec. pp. 108, 110, inc.)

This invention discloses a gear-wheel composed of a plurality of superimposed circular disks of highly compressed textile fibers cut from a batting or a layer of such fibers and stacked one on top of the other, and held under high compression between two metallic plates. It does not disclose a molding composition nor the production of objects from a molding composition. There is no binder nor moldable material involved. The fibrous laminations are mechanically held between metallic plates by means of bolts or rivets running through the gear blank which tie the plates together and maintain the whole under compression. The gear teeth on the periphery of the blank are cut thereon by machining operations in a manner similar to the production of ordinary gears made of steel. This characteristic of the disclosure is evident from the statement taken from lines 81-87, incl., of Miller's specification. (Rec. p. 109.)

> "After the textile body of the gear has been compressed to the proper degree between the metallic end plates and the compression sustaining means secured, the gear blank thus formed may be removed from the press and turned and milled according to the practice in making metallic gears."

It is evident that this patent has no bearing on the present issues and further that its lack of pertinentcy was recognized by the Patent Office.

Re: Talley Patent No. 1,223,216. (Rec. pp. 111, 112.)

This invention discloses a molded gear formed from a composition comprising a resinous binder and a filler composed of unspun fibrous material, the individual fibers of which are slightly longer than the fibrous fillers used prior thereto. The essential feature of this disclosure is that it teaches that somewhat improved strengths are realized in the finished products if the fibers of the filling material are somewhat longer, and are sufficiently long to become interlocked or felted when mixed with the binder. Talley is comparing the strength which he acquires to the strengths of material made from wood flour and like finely divided fillers.

Whereas Talley's disclosure makes specific reference to gear wheels, pinions, or other machine elements, the evidence in this case clearly shows (Rec. p. 21) that Talley did not have in mind heavy duty machine parts of the type referred to in connection with the present invention. The strength of his material is in no sense comparable to the strengths of the material of the present invention nor to the material which has been heretofore referred to as "laminated" material.

Furthermore, this reference was only cited for the suggestion contained in its disclosure to the effect that in so far as individual unspun fibrous fillers are concerned, somewhat greater strength is realized with the longer fibers as compared to the extremely short fibrous, granular, or powdered fillers.

In first citing the Talley patent the Commissioner made the following statement:

> "An additional reference, Talley, is cited herewith, showing that the increase in strength due to the use of long fibers is well known." (Rec. p. 54b.)

RE: KEMPTON PATENT No. 1,513,323. (Rec. pp. 113, 114.)

This invention relates to moldable compositions composed of a binder and a filling material defined as a "loose fluffy mass of long fibers which are substantially uniformly impregnated with the binder employed." Kempton reviews the art as of the date of his invention and points out that inadequate strength is afforded for many purposes by the granular, powdered and short fiber fillers. He then refers to the facts previously taught by Talley with respect to the use of somewhat longer interlocking fibrous fillers and while acknowledging the desirability of longer fibers, from the standpoint of better strength, points out that the longer fibers are nevertheless, much more difficult to impregnate with the binder. Kempton alleges that such fibers exhibit a tendency to roll into balls and wad or stick together in a manner detrimental to their thorough and easy impregnation. His invention accordingly aims to provide an improved impregnation method which in short, involves the saturation of sheets of woven cloth made up of the fibers of the type which he desires to employ. After such sheets are impregnated and dried he subjects them to a treatment which he defines in his specification as follows (See line 105, Rec. p. 113):

> "The impregnated sheet material may then be shredded, chopped up, ground or otherwise comminuted to provide a loose, fluffy mass of long fibers which are substantially uniformly impregnated with the binder employed."

Kempton thus utilizes in his composition an unspun, finely divided fibrous filling material which is substantially the same as the filling material disclosed in the patent to Talley. Thus Kempton and Talley alike represent typical examples of moldable compositions which are highly flowable and in this particular are well suited for use in the formation of irregularly shaped objects by common molding practice. Such materials, however, are of insufficient strength to yield heavy duty machine parts. The uncontradicted testimony of Mr. Cherry (Rec. pp. 18 and 30) is entirely clear in regard to the fact that the compositions of Talley and Kempton are not sufficiently strong to produce objects suitable for heavy duty machine parts and do not even approach the strength of the so-called "laminated" material, or the material of this invention.

Re: Smith Patent No. 1,557,730. (Rec. pp. 115, 118 inc.)

This invention discloses a process for producing a material composed of a fibrous filler and a binder. The filler employed is defined as composed of fibers in the form of yarn. He states that the term "yarn" includes string, thread, cord, twine, etc. He passes the string through a solution of the binder and then dries the same by subjecting it to a special electrical device of his own invention and which does not concern us here. Thereafter he treats the impregnated, continuous and uncut yarn as follows:

> "The impregnated yarn is packed indiscriminately that is, in a tangled or haphazard condition, into the mold so that one portion of yarn may be and is interlocked with another portion, the fibers thereof being thus interlocked and bound together." (Rec. p. 117.)

The essential characteristic of this filling material is that it is continuous and uncut and as a unitary tangled mass it is placed in the mold and compressed. (Rec. p. 22.)

The undisputed testimony of Mr. Cherry (Rec. p. 30) establishes the fact that Smith's material is not moldable in the sense that the material is flowable to form irregularly shaped objects. The material is merely compressible in the same manner that "laminated" material is compressible. The record further shows that Smith's material is quite strong and is sufficiently strong to be used for heavy duty machine parts and in this way is likewise similar to laminated material. However, such machine parts could only be formed therefrom by machine cutting operations in exactly the manner by which such parts would be formed from the so-called "laminated" material.

Thus it is an uncontroverted fact that Smith shows merely a material which in properties and utility, is substantially an equivalent of the well known "laminated" materials, the only difference being that it is composed of a tangled mass of a continuous length of yarn or string which is compressed to form a blank whereas the "laminated" material is made up of superimposed layers of impregnated sheets of cloth or paper. The term "moldable" as used by Smith means compressible.

ELLIS PUBLICATION—ARTICLE ON FILLERS, pp. 378-380. (Rec. pp. 119-121 inc.)

This publication discloses nothing more than is clearly admitted to be the state of the art at the time the present invention was made. It defines the use of finely comminuted filling materials, such as wood flour, asbestos fibers, cotton flock, cotton linters, silk flock and powdered fillers. These are all finely divided materials, heretofore regarded as requisite to flowability. There is also a brief paragraph (Rec. p. 121), explaining the formation of "laminated" products called "press board" made from paper and canvas. Appellant's witness, Mr. Cherry has explained in detail the nature of this disclosure (Rec. p. 29) and further showed by uncontroverted testimony, that there is nothing contained therein to suggest that flowability could be realized by using materials other than finely divided materials.

THE INVENTION IS NOVEL AND USEFUL.

There is no contest in regard to the fact that the composition of this invention is the first to combine moldability and high strength. The defendant has not contested this fact. Furthermore, there is no dispute in regard to the disclosures of the prior art references relied upon and as is plainly evident from an inspection of the references, none of them disclose a molding composition of the type defined by the claims of the application here under consideration. None of the references show a molding composition consisting of relatively short pieces of string and a binder of the type claimed. The binder *per se* is admittedly old but in no case has this been used with relatively short pieces of string. Thus, the invention is novel, and is not disclosed or taught in any of the prior art references.

The record shows that the characteristics of the composition here claimed are productive of new and useful results which constitute an important advance in the art. The testimony and the cited references disclose that prior to this invention the resinous materials of this sort were of two distinct types, the first, the relatively weak, moldable compositions of inadequate strength for heavy duty machine parts, such as Talley and Kempton, and those made from wood flour, asbestos, and finely divided unspun fibrous fillers, and, secondly, the compressible, non-flowable and non-moldable materials which could be made into blanks and from which strong heavy duty machine parts could be subsequently made by machining operations.

That the production of a moldable composition which has improved strength properties, superior to those of "laminated" products and Smith's product and which is usable for irregularly shaped objects and machine parts, is a highly useful and desirable advance in the art, cannot be denied. On the basis of the established law this fact alone raises a strong presumption in favor of patentability of this invention.

THIS INVENTION IS NOT A MATTER OF DEGREE.

Although the Commissioner of Patents repeatedly urged that this invention is one of a "degree" change intermediate the disclosures of Kempton and Smith, it can not be clearly determined what was intended by this contention. The facts established by uncontroverted testimony in this record, do not support any possible interpretation of the Commissioner's position which will provide a valid ground for refusing the patent.

If the Commissioner of Patents meant that even though the references do not disclose this composition, that notwithstanding it would not be invention to cut the continuous string of Smith into pieces to produce the present invention, this position is contrary to the established law as recited in the case of *Topliff* v. *Topliff,* 145 U. S. 156-161.

Whereas, the Commissioner early in the prosecution of the application (Rec. p. 72), refused this patent on the grounds that cutting the continuous length of yarn of Smith's disclosure could not amount to a patentable invention, Mr. Justice Brown, in delivering the opinion in the above case for the Supreme Court announced the well established principle to the contrary in the following language:

> "It is not sufficient to constitute an anticipation that the device relied upon might, by modification, be made to accomplish the function performed by the patent in question, if it is not designed by its maker, nor adapted, nor actually used, for the performance of such functions."

Smith was aiming to produce a strong material and the inference from his disclosure is that his strength depends upon the continuity of the yarn, that is, if the continuity is lost the strength is lost. A disclosure must be read in its entirety and with its intended meaning and as Smith teaches the use of continuous yarn, he necessarily teaches that the yarn must not be cut. To cut the yarn of Smith with the production of a composition having better strength qualities, while at the same time having moldability, is clearly invention.

The relatively short length of string filling material of this invention produces greater strength qualities than the material of the Smith patent on account of the ability of the shorter pieces to become oriented and adjusted in the molded piece. In the absence of actual discovery to the contrary it would naturally be thought that the cutting of the string of Smith would be productive of a diminished strength rather than an increased strength. Furthermore, the fact that a filling material of relatively short pieces of string is flowable to an extent to render it commercially moldable is also patentable discovery in the light of the prior art which demands for flowability the employment of individual unspun fibrous or finely divided filling materials.

In finally refusing the patent the Commissioner of Patents apparently contended that Kempton's disclosure suggested a modification of Smith which would result in this invention or that Smith suggested a modification of Kempton which would produce this invention. However, the facts do not support either of these positions. Kempton teaches the impregnation of cloth and the subsequent chopping or shredding of such cloth to reduce it to individual fibers. If Smith were modified in the light of Kempton his continuous ball of yarn should be shredded or chopped to reduce the same to the individual fibers composing it. The lack of pertinency of such procedure is too obvious to require comment. On the other hand, it is not seen how Kempton could be modified in accordance with the teachings of Smith. The nature of the disclosures are such that they are devoid of any such possibility.

Irrespective of the legal theory entertained by the Commissioner of Patents in contending that this invention was taught by the disclosure of Smith and Kempton, it is clear that by the use of the term "degree" he was referring to a degree difference in the size of the filling material without regard to the character of the filling material.

With this in mind, he next imagined a range of compositions starting with the highly subdivided fibrous filler of Kempton at one extremity and extending to the single, uncut, fibrous string of Smith at the other extremity. Without any knowledge of actual compositions intermediate these two extremities he surmised that a high degree of subdivision of any filler produced flowability with relatively low strength and that lower degrees of subdivision produced increased strength with less flowability and that thus strength and flowability were opposed qualities, either one being increased only at the expense of the other. On this basis it was concluded that one can select the particular properties desired and then by mere subdivision of the filler to the proper degree one can obtain the desired combination of strength and flowability. It was on this basis that the Commissioner of Patents contended that this invention involved only a change in degree which did not amount to invention.

The record however, shows that the assumptions made by the Commissioner are contrary to the true facts. The appellant's witnesses have shown (Rec. p. 23) that the strength and flowability are not opposed characteristics but that improved flowability produces an improved strength for any particular filling material. Mr. Cherry discovered that the improved strength is due to the ability of the filling material to find its own position within the mass when subjected to the severe molding pressure. Thus for maximum strength for any particular molded object there is an upper limit of length for the filling material beyond which the strength will be impaired. The impaired strength results from the fact that unduly long pieces of filler become so interlocked with each other that they cannot yield and move and thus seek and find their own unstrained positions with relationship to each other and in this way become oriented in the finished piece.

It was the discovery of these inventors that substantially the maximum strength attainable with string-like filling material is realized with pieces of approximately two inches in length or less (Rec., p. 178; Plaintiffs' Exhibit No. 1) and that at the same time, a molding composition of the type here claimed having a filling material of such limited length is also flowable to an extent enabling its use for the production of irregularly shaped objects by commercial molding operations.

It is not disputed that there is some difference in the flowability and moldability of the various possible compositions of this invention, depending upon the length of the string pieces employed and that to this extent, is it possible to select somewhat different properties, however, this should not be confused with the erroneous contention that the present invention occupies a position intermediate the disclosures of Smith and Kempton, and differing therefrom, only in a matter of degree.

TESTS OF MR. HERBST (PLAINTIFFS EXHIBITS 5, 6, AND 7.)

That this invention is not intermediate the disclosures of Smith and Kempton is clearly established by the testimony of Mr. Herbst and the tests conducted by him and illustrated graphically on the charts, Plaintiffs' Exhibits 5, 6, and 7, (Rec., pp. 175, 176 and 177). These charts show, for instance, that the impact strength of the shortest string material (⅛ of an inch) claimed for this invention is over twice as strong as the fibrous material of Kempton and at the same time has approximately twice the flowability. This testimony is uncontradicted and thus it cannot be questioned that the new and useful results produced by this invention are not mere degree changes intermediate the results of the Smith and Kempton patents. If intermediate these patents, a gain in strength would decrease the flowability, but as shown above the contrary is true. See Plaintiffs' Exhibit 7, (Rec., p. 177), where it will be noted that the ⅛ inch string is not only twice as strong but is also twice as flowable as Kempton.

The flowability and strength properties of other possible lengths of the string filler are illustrated on the Exhibit charts by the red lines which may be compared to the green and blue lines appearing below.

On each of these charts, the vertical ordinate represents the strength of the material, whereas the horizontal ordinate represents the flowability of the material in grams per minute, through a given opening. The various points marked thereon have been placed by actual test to represent the strength and flowability of each and, it will be noted that, two points are given for Kempton because he has two different materials mentioned in his patent, which have different strength and flowability characteristics.

When the Commissioner of Patents refused this patent on the grounds that the invention was merely one of degree intermediate the patents to Smith and Kempton, he erroneously assumed that the strength and flowability qualities of this invention were those represented by the green or blue on these charts, whereas in fact, the actual properties of appellant's composition are shown by the red line on each of said charts. The superiority of both strength and flowability as represented by the red line is too obvious to require further comment.

For the Court's information, the three charts are of the same type but represent tests for different strength qualities. Plaintiffs' Exhibit 5, (Rec., p. 175) illustrates flowability and tensile strength. "Tensile" strength is that strength which resists longitudinal pull, such as the strength of a rope under load.

Plaintiffs' Exhibit 6, (Rec., p. 176) illustrates flowability and transverse strength. "Transverse" strength is that strength which resists breakage in a transverse direction under a gradually increasing load. If a board is bridged across two spaced supports and a load gradually applied thereto overlying the space, the strength of the board which resists breakage under this condition is transverse strength.

Plaintiffs' Exhibit 7, (Rec., p. 177) illustrates flowability and impact resistance. Impact resistance is the strength of a material which resists breakage or fracture by impact blows such as breakage by striking with a hammer or being forcefully projected against a hard surface. We know that there are many objects which will not break or crush under a gradually applied load but which may be broken or smashed by forcefully projecting them against a hard surface.

A comparison of the charts will disclose that the marked improvement of this invention lies in the extraordinary and unpredictable increase in the strengths of this material, and particularly in the impact strength thereof.

THE LAW ON "DEGREE CHANGES."

The appellant has treated rather fully, the question of "degree change" because it appears to have been the sole grounds on which this patent was refused. It was the only stated grounds in the record before the Patent Office and reference to the opinion of the Court below (Rec. p. 9) will show that the decision against the appellant affirming the position taken by the Commissioner of Patents was based on the same conclusions.

The opinion is as follows:

> "I agree with the conclusions reached by the Board of Appeals of the Patent Office and the Bill will be dismissed with costs."

The law relating to "degree changes" comes to us from cases, such as *Smith* v. *Nichols*, 88 U. S. 112, in which the Supreme Court has pronounced that well settled principle of law as follows:

> "A mere carrying forward of the original thought, a change only in form, proportions, or degree, doing the same thing in the same way by substantially the same means, with better results, is not such an invention as will sustain a patent."

This principle has also been restated and adhered to in numerous other cases:

Consolidated Roller Mill Co. v. *Walker*, 138 U. S. 124.

Ansonia Brass & Copper Co. v. *Electrical Supply Co.* 144 U. S. 11.

Belding Mfg. Co. v. *Challenge Corn Planter Co.* 152 U. S. 100.

Railroad Supply Co. v. *Elmire Iron & Steel Co.* 244 U. S. 285.

The soundness of this principle is believed to be obvious. According to this principle, a "degree" improvement is merely that which accomplishes the same result, though better, by substantially the same means and in substantially the same way.

The present invention accomplishes an entirely new result and embodies for the first time high strength and moldability in the same material. These qualities have never before been embodied in one composition. It does not produce either of these qualities by means which are common in the prior art. The moldability of Kempton is attributable to his use of finely divided, unspun, fibrous filling material, whereas the moldability here is derived from short pieces of filling material in combination with the binder, as claimed. The strength is due to the strength of the string pieces and not to a single uncut piece of yarn as taught by Smith.

The invention is predicated on a discovery of qualities which were nowhere suggested in the prior art. There is no suggestion in the prior art that string of two inch length is stronger than continuous string. There is no suggestion in the prior art that impact strength is greatly increased by employing string filling material. There is no teaching in the prior art that string of two inches or less, produces a highly moldable composition, nor that by combining moldability and the high strength of short string pieces, that orientation of the filling material results, and a moldable composition is produced from which heavy duty machine parts can be made.

It is thus believed that the Commissioner of Patents and the Court below, were clearly in error in holding this invention to be a "degree change."

THE CLAIMS.

As above pointed out, and as established by the testimony of Mr. Cherry (Rec. p. 23) the limited length of approximately two inches is critical to the practice of this invention. Certain of the claims such as 10 and 12, define this length specifically as follows:

"of length less than two inches"

whereas, the remaining claims "refer to relatively short lengths of spun, fibrous material in string like form." This last expression is of course limited by the specification, which provides (Rec. p. 52)

> "The essential feature is to provide a filler of string-like characteristics without limiting the invention to any particular length of pieces or thickness of materials, provided only that the filling material behave in the manner taught in this invention."

The specification then continues with an expression of the behavior of the exact lengths and fixes two inches as the approximate upper limit for good results.

The important consideration in regard to the length of the filling material is illustrated in Plaintiffs' Exhibits 8 and 9, (Rec. pp. 178, 179) which show tests conducted by Mr. Herbst. (Rec. pp. 39-41 incl.). Both charts show that the desired characteristics of strength produced by string material as a filler are fully realized with pieces in the neighborhood of approximately 2 inches and that above this length, the strength does not increase materially but may actually decrease. (See Transverse Strength, Plaintiffs' Exhibit 9, Rec. p. 179).

Thus in addition to the discoveries above pointed out, these inventors have further discovered that the maximum strength qualities for string material can be realized within the limited lengths of approximately 2 inches and that within this same limit of length, a high degree of moldability is also realized. The technical significance of these properties in combination will be better appreciated when it is realized that the improved strength depends to some extent upon the high degree of flowability which results from the filling material becoming oriented in the finished molded piece.

PLAINTIFFS' EXHIBIT 8, (Rec. p. 178)

This chart illustrates a series of tests which need not be considered in detail, but which show that other characteristics of the molding composition cannot produce the qualities of strength and flowability which are here attributed to the kind and length of filling material. During the prosecution before the Patent Office the Commissioner urged that the claimed characteristics were not critical to the results obtained as the same results could be produced by modifying various other characteristics of the molding composition. This chart which is supported by the testimony of both of plaintiffs' witnesses, (Rec. pp. 24-41, incl.) shows that the qualities of the composition depend for their existence solely upon the claimed characteristics.

CONTROLLING LAW.

It has been shown that the invention is not "a degree change."

The following law is now cited as controlling:

Carnegie Steel Co. v. *Cambria Iron Co.* 185 U. S. 403-446.

In this case the United States Supreme Court sustained a patent over a series of citations and examples of public use that were so close and compelling that only the most liberal viewpoint and the firmest recognition of result could overcome. In the opinion of the Court Mr. Justice Brown stated:

> "It should be borne in mind that this process was one not accidentally discovered, but was the result of a long search for the very purpose. The surprise is that the manufacturers of steel, having felt the want for so many years, should never have discovered from the multiplicity of patents and of processes introduced into this suit, and well known to the manufacturers of steel, that it was but a step from what they already knew to that which they had spent years in endeavoring to find out. It only remains now for the wisdom which comes after the fact to teach us that Jones discovered nothing, invented nothing, accomplished nothing.
>
> We cannot better conclude this opinion than by the following extract from the opinion of Mr. Justice Bradley, in *Loom Co.* v. *Higgins,* 105 U. S. 580, 591: 'But it is plain from the evidence, and from the very fact that it was not sooner adopted and used, that it did not, for years, occur in this light to even the most skillful persons. It may have been under their very eyes, they may almost be said to have stumbled over it; but they certainly failed to see it, to estimate its value, and to bring it into notice. * * * Now that it has succeeded, it may seem very plain to anyone that he could have done it as well. This is often the case with inventions of the greatest merit. It may be laid down as a general rule, though perhaps not an invariable one, that if a new combination and arrangement of known elements produce a new and beneficial result, never attained before, it is evidence of invention.' "

Eibel Co. v. *Paper Co.* 261 U. S. 45-63.

In this case the U. S. Supreme Court sustained a patent for an improvement in paper machines in which the only change over the prior art was the placement of the paper screen at a slight angle instead of leaving it horizontal as it had previously been used. Although the change in the machine was slight, the difference in result was unexpected and great. The capacity of the machine was increased to an astonishing degree. In its opinion, sustaining the patent the Court said:

> "In administering the patent law the court first looks into the art to find what the real merit of the alleged discovery or invention is and whether it has advanced the art substantially. If it has done so, then the court is liberal in its construction of the patent to secure to the inventor the reward he deserves. If what he has done works only a slight step forward and that which he says is a discovery is on the border line between mere mechanical change and real invention, then his patent, if sustained, will be given a narrow scope and infringement will be found only in approximate copies of the new device. It is this differing attitude of the courts toward genuine discoveries and slight improvements that reconciles the sometimes apparently conflicting instances of construing specifications and the finding of equivalents in alleged infringements. In the case before us, for the reasons we have already reviewed, we think that Eibel made a very useful discovery which has substantially advanced the art. His was not a pioneer patent, creating a new art; but a patent which is only an improvement on an old machine may be very meritorious and entitled to liberal treatment. Indeed, when one notes the crude working of machines of famous pioneer inventions and discoveries, and compares them with the modern machines and processes exemplifying the principle of the pioneer discovery, one hesitates in the division of credit between the original inventor and the improvers; and certainly finds no reason to withhold from the really meritorious improver, the application of the rule *'ut res magis valeat quam pereat'*, which has been sustained in so many cases in this Court. *Winans* v. *Denmead,* 15 How. 338, 341; *Corning* v. *Burden,* 15 How. 265, 269; *Turrill* v. *Railroad Co.* 1 Wall. 491; *Rubber Co.* v. *Goodyear,* 9 Wall. 788, 795; *McClain* v. *Ortmayer,* 141 U. S. 419, 425."

Gandy v. *Main Belting Company,* 143 U. S. 587-594.

In this case, the U. S. Supreme Court sustained a patent over very close prior art for an improvement in transmission belts composed of canvas duck having its warp thread larger than the weft, with both hard spun, and with the fabric tightly folded, stitched and saturated with linseed oil. The claimed construction provided improved wearing qualities and resistance to cracking under the bending influence of small pulleys. In its opinion the Court said:

> "In view of the fact that previous attempts, of which there appear to have been several, to make a practical canvas belt had been failures, and that Gandy had been experimenting with the subject for several years before he discovered that a change was necessary in the structure of the canvas itself, we do not think his improvement is a change in degree only, or such an one as would have occurred to an ordinary mechanic, and our opinion is that it does involve an exercise of the inventive faculty. The change is such as would only have occurred to one familiar, not alone with the impossibility of making a practical belt out of the ordinary canvas, but to one who had bestowed considerable thought upon the method of overcoming the difficulty."

Furthermore, the following decisions clearly state the controlling law on anticipation:

> (D. C. Ohio, 1927) "As to mechanical patents, the law is settled that prior patents are not a part of the prior art, except as to what is disclosed on their face, and that they cannot be reconstructed in the light of the invention in suit, and then used as an anticipation or to repel novelty." *Buckeye Incubator Co.* v. *Blum,* 17 F. (2d) 456, 457.
>
> (C. C. A. 3rd Cir., 1929) "A patent relied upon as an anticipation must itself speak. Its specification must give in substance the same knowledge and the same directions as the specification of the patent in suit. * * * It is not enough to prove that a method or apparatus described in an earlier specification can be made to produce this or that result. * * * A singularly sensible test of the rule of anticipation is given in *British Thomson-Houston Co.* v. *Metropolitan Vickers Electrical Co.* 45 R. P. C. 22, by asking the question—'Would a man who was grappling with the problem solved by the patent attacked, and having no knowl-

> edge of that patent, if he had had the alleged anticipation in his hand, have said: "That gives me what I wish"?' (Affirming decrees 20 F. (2d) 995, 23 F. (2d) 111.) *Skelly Oil Co.* v. *Universal Oil Products Co.* 31 F. (2d) 427, 431."

The above legal principles have been repeatedly laid down by the Supreme Court of the United States and have been recently adhered to in the case of *Smith* v. *Snow,* 294 U. S. 1, decided January 13, 1935. Here a patent was involved on a process for the incubation of eggs and although numerous prior art references, showing somewhat similar devices, were cited as the basis for invalidating the claims, Mr. Justice Stone, in delivering the opinion of the Court made the following statement in holding the claims valid and infringed:

> "This history of the prior art serves to emphasize rather than to discredit the striking advance made by Smith in effecting the combination defined in claim 1. More than the skill of the art was involved in combining and adjusting its elements in such fashion as to solve the major problems of artificial incubation. The prior art discloses no application of a continuously circulating current of air to eggs in staging incubation which would restrict claim 1 with respect either to the arrangement of the eggs or the direction or control of the current of air."

A study of the facts of this case will reveal that they are very analogous to the facts at hand. In the present case the prior art fails to teach the combination of high strength and moldability.

CONCLUSION.

It is respectfully submitted that the Commissioner of Patents and the Court below failed to recognize the distinct advance provided by this invention and erred in holding that this invention is a "degree change" intermediate the patents to Smith and Kempton.

Consequently, it is respectfully submitted that the decree of the Court below should be reversed and that the prayers of the appellant's bill of complaint should be granted.

Respectfully submitted,

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JAMES P. HUME,

HENRY M. HUXLEY,

Of Counsel.

FOR MR. CHIEF JUSTICE MARTIN

UNITED STATES
COURT OF APPEALS FOR T
DISTRICT OF COLUMBIA
FILED NOV 19 1935

No. 6510

In the United States Court of Appeals for the District of Columbia

OCTOBER TERM, 1935

ECONOMY FUSE AND MANUFACTURING COMPANY,
APPELLANT

v.

CONWAY P. COE, COMMISSIONER OF PATENTS,
APPELLEE

BRIEF FOR THE COMMISSIONER OF PATENTS

APPEAL FROM THE SUPREME COURT OF THE DISTRICT OF COLUMBIA

R. F. WHITEHEAD,
Solicitor, United States Patent Office.

In the United States Court of Appeals for the District of Columbia

October Term, 1935

No. 6510

Economy Fuse and Manufacturing Company,
appellant
v.
Conway P. Coe, Commissioner of Patents,
appellee

APPEAL FROM THE SUPREME COURT OF THE DISTRICT OF COLUMBIA

BRIEF FOR THE COMMISSIONER OF PATENTS

This is an appeal from a decree of the Supreme Court of the District of Columbia dismissing a Bill which was filed by appellant under the provisions of Section 4915 R. S. (35 U. S. C. A. 63, as amended).

By that Bill it was sought to have the Court authorize the issuance to the plaintiff (appellant here) of a patent on the application of O. A. Cherry and Franz Kurath, for a Moldable Composition of Matter and the Process of Producing the Same.

The subject-matter of the application is a thermoplastic molding composition and relates to the process of molding employing such composition and to the finished molded articles produced therefrom.

The molding composition consists of two ingredients, namely, a binder and a filling material. The binder is a phenolic condensation product and the specific filler used is described as being pieces of string, preferably a cotton cord, cut in lengths of one-eighth of an inch to two inches.

The claims in question are numbered 8 to 13, inclusive, of which claim 8, for the composition, claim 11, for the process of molding, and claim 13, for the molded article, are illustrative:

> 8. A thermoplastic molding composition comprising a thermoplastic reactive resinous binder and a filler consisting of relatively short lengths of spun fibrous material in string-like form.
>
> 11. The process of molding which consists in coating a continuous length of spun fibrous string material with a solution of a thermoplastic reactive resin, drying the coated string, cutting the coated string into relatively short lengths and molding an intermingled mass of the short lengths of string under conditions of heat and pressure in such a manner that the mass flows to an appreciable extent during molding.
>
> 13. A molded article of manufacture of irregular shape and uniform quality having

> a high tensile strength and high resistance to fracture by impact comprising an insoluble and infusible resin and a filler of relatively short lengths of spun fibrous string-like material formed *in situ.*

Admittedly (see page 4 of Appellant's brief) molding compositions of the general type of applicant's are not new. The so-called thermoplastic resins were well known, as well as the process of making them and their characteristics, one of the characteristics of the thermoplastic resin being that it could be softened by heat and when molded under heat and pressure would become hard.

It is claimed that the composition set out in the application is capable of flowing in the mold so as to form objects of irregular shape which are as strong as machined steel. In other words, that the composition is both moldable and productive of that high degree of strength required for machine parts.

The claims were rejected by the Patent Office in view of the following patents:

Miller, 1061770, May 13, 1913,
Talley, 1223216, Apr. 17, 1917,
Kempton, 1513323, Oct. 28, 1924,
Smith, 1557730, Oct. 30, 1925,

the last three of which disclose compositions of the same general nature as that disclosed in the application of appellant.

The Talley patent, No. 1223216, discloses a molded gear formed from a composition comprising a resinous binder and a filler composed of unspun fibrous material. This product is moldable and it has greater strength because of the introduction of the filler.

The Kempton patent, No. 1513323, discloses a similar moldable composition and describes the advantages of different kinds of fillers and aims at an improvement by impregnating a sheet of woven cloth with the desired resin, then shredding, chopping up, or otherwise comminuting this sheet of cloth, and then placing this in a mold and molding the desired object under heat and pressure. Admittedly, the Kempton product can be molded and has strength though it is alleged that that strength is not sufficient for the making of heavy-duty machine parts.

The Smith patent, No. 1557730, describes a similar product. Smith, however, uses a string impregnated with a resinous binder and then takes that impregnated string and packs it indiscriminately in the mold.

According to the testimony of the witness Cherry, the Smith material is not moldable, meaning, as understood, it is not moldable into articles where the material must flow into the interstices of the mold. In other words, it does not possess what the witness calls "flowability." It is admittedly, however, of great strength.

Attention was called to an article by Carleton Ellis, entitled "Fillers", appearing on pages 378 to 380, in "Synthetic Resins and their Plastics", published by The Chemical Catalog Company, Inc., of New York, N. Y., which describes these plastic materials and also at great length describes the fillers that have been used, both powdered and fibrous.

It is the position of the Patent Office that there was no invention, especially in view of the Kempton and Smith patents, in making the fillers of short pieces of string. In other words, it was old to use short fillers of a fibrous material and it was old to use string, as shown in the Smith patent, and therefore, the art had taught both the use of fibrous fillers and the use as a filler of a string.

It is submitted that what applicants did, even taking the most favorable view, was to obtain a moldable composition having greater strength than that of the product of the Kempton patent and greater flowability or moldability than the product of the Smith patent.

It is submitted, therefore, that it was correctly held that the result which applicants obtained was merely a change in degree.

It is too well settled to need the citation of decisions that mere novelty and utility are not sufficient to support a patent but there must be found the added quality of invention.

It is also well settled that a mere change in degree is not sufficient to sustain a patent.

It is submitted, therefore, that with the art of record before them, applicants were informed of all that was necessary to teach them how to make the composition of the kind covered by some of the appealed claims and that that being true there was no further invention in the process of molding set out in Claim 12 or broadly in making an article of the particular composition defined by Claim 8.

It is submitted, therefore, that the claims were properly refused and that the decree of the Supreme Court of the District of Columbia should be affirmed.

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Attorney for Appellee.

NOVEMBER 1935.

U. S. GOVERNMENT PRINTING OFFICE: 1935